AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Published by Howes Publishing Company, 90 William Street, New York

Devoted to the practical application of dyestuffs in all industries; especially to textile chemistry—the science and practice of scouring, bleaching, dyeing and finishing.

VOL. XVII NEW YORK, FEBRUARY 6, 1928 No. 2

Bleaching Wool With Hydrogen Peroxide

The Ideal Wool-Bleaching Equation—Wool or Worsted Yarns—The Bleaching Action—Machine Operation—Bleach Control—Spoilage—Wide Fabrics—Narrow Fabrics—Wool Hosiery

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WOOL is generally considered a combination of proteins having a pH-4.8. This acid character of the wool fiber makes it readily reactive with alkali, even dilute alkali. There are definite maximum alkaline limits for bleaching (and scouring) wool without injury to its structure.

In bleaching wool with alkaline solutions of hydrogen peroxide it is quite important to keep within these limits; but to get the best bleach it is necessary to start the action of the hydrogen peroxide at the maximum safe alkalinity. Any peroxide bleach liquor having a pH greater than 4.8 will be alkaline to wool and will bleach it to some extent. The exactly proper bleach liquor for a particular wool material depends on the hydrogen peroxide, on the alkali and on the equipment used.

The wool bleaching equation in its ideal form is:

$$\underset{\text{(probably Sulphur Compounds)}}{\text{Wool Coloring Compounds}} + H_2O_2 + NaOH = Na_2SO_4 + \underset{\text{(or Sulphonates)}}{\text{NaSalts}} + H_2O + O_2 + O_2 \qquad \text{(Eq. 4)}$$

The formation of oxygen gas is due to the fact that much less alkali must be used than the molecular equivalents of Eq. 4 require, on account of the susceptibility of wool to the chemical action of alkali.

Wool may be bleached with hydrogen peroxide in any stage of its manufacture, viz., raw stock, slubbing, tops, yarns, wide fabrics, narrow fabrics, hosiery, etc. The bleaching of raw stock, slubbing and tops is very special processing which is not used to any large extent because the later operations on the wool destroy, to some degree, the value of this bleach.

Wool (or Worsted) Yarns

Wool yarns are usually bleached loosely or on sticks in open kettles; loosely or on sticks in machines.

Open Kettle Operation.—There are, generally speaking, two types of kettles or machines for bleaching wool yarn: (1) the continuous kettle, in which the bleach liquor, with additions, is used over and over again; and (2) the batch kettle, in which the bleach liquor is dropped after each batch.

The continuous kettle will produce a better bleach, for a given cost, than the batch kettle and should be used wherever the local conditions are not unfavorable. The quality of the water, cleanliness of the bleach house, kind and quality of yarns bleached, type of equipment and skill of the bleacher all determine the practicability of a continuous kettle.

It is usually advisable to standardize on the quantity of bleach liquor that is to be used. Therefore, the proper size and shape of the bleach kettle deserves some consideration. It is somewhat more expensive to bleach yarns in kettles that are too large for their lots. On the other hand, overcrowding of kettles results in uneven bleaching because the tightness of the packing may prevent even penetration by the bleach liquor. In very small kettles a false bottom occupies a relatively large amount of space; in very large kettles it is difficult to get circulation of the liquor and hard to remove the yarn without dropping the liquor.

Uniformly good results are obtained when 500 to 600 pound lots of yarn are bleached in 600 to 700 gallons of bleach liquor. A kettle 10 feet long, 3 feet high, and 3 feet 6 inches wide is quite satisfactory for such lots and convenient to operate. The lining of a kettle with Monel metal is an improvement, which, although high in first cost, will save this cost in bleach chemicals alone in a year or two. The heating is done by a closed coil in the bottom of the kettle.

Any good hydrogen peroxide will bleach wool yarns. The quality of the peroxide will be indicated by (1) the clearness of the bleached yarn, (2) the luster of the yarn,

(3) the softness of the yarn, (4) the length of time during which a kettle can be continuously operated, (5) the total peroxide consumption relative to the total alkali consumption.

The most practicable alkali for wool yarn bleaching, from the standpoints of whiteness, condition and cost, is silicate of soda. A 42 deg. Be. water white, clean, free flowing silicate is desirable. Only the best grade of silicate, such as Star brand, contains impurities which are almost entirely inactive and non-injurious to the ingredients of the bleach liquor. The iron content of inferior silicates usually causes staining, destruction of peroxide and sometimes burning of the yarn.

A continuous kettle is comparatively easy to operate. It is filled with water to a standard mark. Then, calculated quantities of hydrogen peroxide and silicate are added and the whole thoroughly mixed. The bleach liquor is heated to 120 to 135 deg. Fahr. (on coarse, heavy wools the temperature may go to 150 deg. Fahr.), the steam is shut off and the scoured yarn is entered and uniformly distributed throughout the kettle. The yarn should wet out and sink at once. A suitable cover is used to hold the yarn under the surface of the liquor throughout the entire bleach period.

A one-volume hydrogen peroxide bath, containing the maximum safe quantity of silicate gives a clear, soft bleach, which becomes a beautiful white in the sulphur chambers.

Within a half hour, the whole batch of yarn is almost completely covered with bubbles of oxygen gas. This is molecular oxygen, formed as a by-product in the bleaching of wool. (See Eq. 4.) It is erroneously believed by many bleachers that these bubbles do the bleaching. As a matter of fact, the bleaching is materially hastened if the bubbles are shaken off, as the bleaching of wool with hydrogen peroxide is not a gas reaction. The presence of these bubbles indicates a waste of hydrogen peroxide which cannot be avoided on account of the unbalanced alkaline content of the bleach liquor. That is, if sufficient alkali is used in the bleach bath to balance Eq. 4 and prevent the formation of oxygen gas, the wool will be harshened or even tendered.

As soon as the yarn is immersed in the bleach liquor there is a rush of this liquid into the fiber and the bleaching starts at once. The bleached yarn may be taken out in from two to eight hours, depending on the whiteness desired and on the amount of coloring material that can be destroyed by the peroxide bleach bath used. After about one and one-half hours, there is little or no passage of bleach liquor into the fiber. As far as the bleach bath is concerned, its action is completed at this time. However, the liquor within the fiber continues its work. If, after two hours, yarn is removed from a kettle in such a manner that its absorbed liquor is retained, practically the same bleach will result as if the yarn had been kept in the kettle. Ordinarily from six to ten hours will put a full peroxide bleach on wool yarns in a continuous kettle.

The bleached yarn is lifted out of the kettle and allowed to drain or is whizzed. The drained or whizzed liquor should be returned to the kettle as it contains an appreciable amount of H_2O_2. Under normal conditions from 10 to 30 per cent of the bleach liquor will be removed physically from the kettle by each batch of yarn that passes through it. If a good hydrogen peroxide, clean silicate and soft water are used, it is necessary only to lightly rinse the yarn at this stage of the bleaching process and give it a partial whizzing, if it is to go on to the sulphur chambers. Yarns that are to be only peroxide bleached must be given an acid rinse to neutralize all the alkali remaining in the fiber from the bleach liquor. Otherwise the drying of even the very dilute alkali in the yarn may produce tenderness.

Wool yarns, taken out of a hydrogen peroxide bleach, should have the same slight reddish cast that is visible on freshly fallen snow. A greenish or a grayish cast is not as desirable as the former, which becomes a clear, soft, glistening white when the yarn is acted on by the sulphur dioxide in the sulphur chamber.

Fig. VII shows the peroxide and alkali curves of 70 bleaches in a continuous kettle. The cost of chemicals (hydrogen peroxide and silicate) in a continuous kettle for a full peroxide bleach on wool yarn is about $1.20 per hundred pounds of yarn.

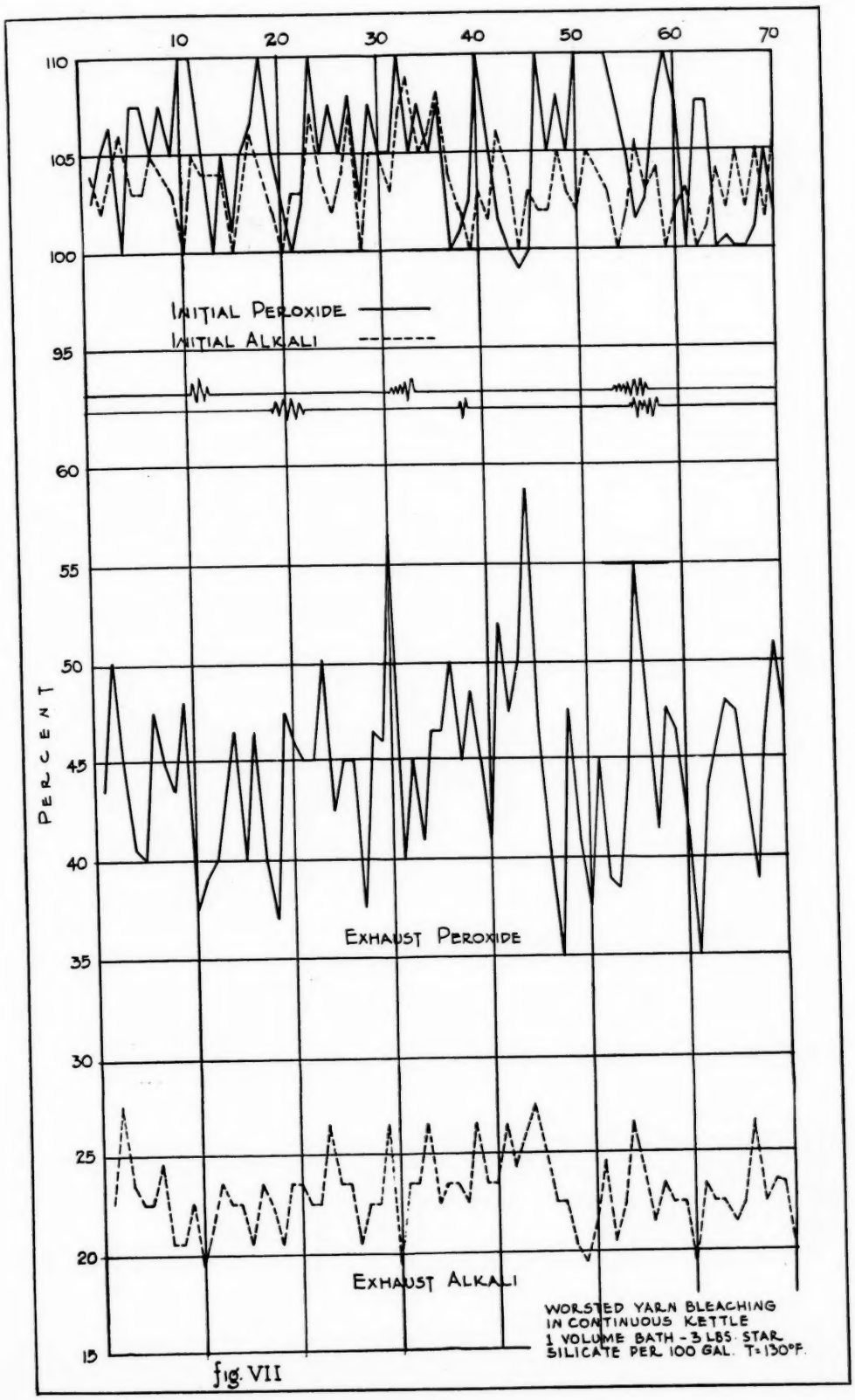
With a few changes in the alkalinity of the bleach liquor, excellent bleaches can be put on mixed yarns of wool and silk, wool and rayon, wool and cotton. Wool-silk yarns may also be double bleached.

Yarns that are too fragile to be thrown loosely into a bleach liquor are bleached on sticks in a manner similar to hand dyeing. The type of bleach liquor necessary is entirely dependent on the wools, spinning, etc., of the yarn and is a special case for each kind of such yarn. There is, however, very little of this kind of bleaching done.

Machine Operation

A machine for bleaching wool yarn contains a device for either moving the yarn through the bleach liquor (e.g., a Klauder Weldon dyeing machine) or for moving the bleach liquor through the yarn (e.g., a Franklin dyeing machine).

When the yarn or liquor is in motion, the bubbles of oxygen gas are brushed off shortly after they form on the yarn. The bleaching therefore takes place much more quickly than in a standing kettle. In the Klauder Weldon Machine the yarn is immersed in the liquor only a part of the time during which the bleaching goes on so that a much stronger bleach liquor may be used and the temperature may be maintained at 130 to 150 deg. Fahr. This still further reduces the bleaching time. Practically the same whiteness may be obtained in a machine bleached yarn as in an open kettle bleached yarn. However, the condition of the fiber and the feel of the yarn are different. Soft spun yarn scoured and bleached in a Klauder Weldon Machine is several inches longer in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INITIAL PEROXIDE
INITIAL ALKALI
EXHAUST PEROXIDE
EXHAUST ALKALI
WORSTED YARN BLEACHING
IN CONTINUOUS KETTLE
1 VOLUME BATH - 3 LBS. STAR
SILICATE PER 100 GAL. T=130°F.

fig. VII

the skein than a kettle bleached yarn, which, for the same weight skein makes a great difference in the softness and fluffiness of the threads. Machine bleaching is satisfactory, however, for hard twist yarns.

The advantage of machine bleaching is that the same yarn holder may be used for both the scouring and the bleaching, thereby decreasing the manual handling necessary. The drawback of machine bleaching, in addition

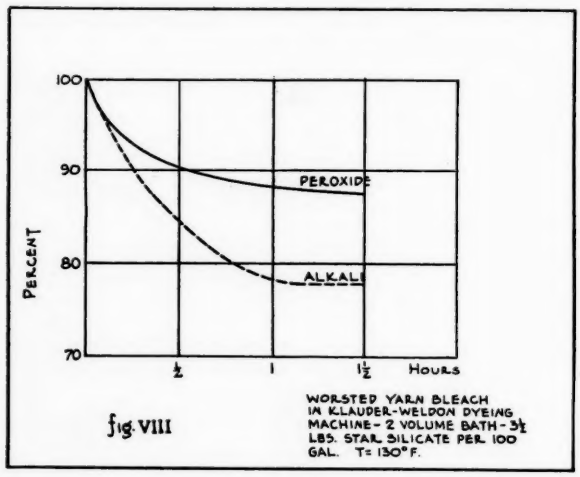

fig. VIII

WORSTED YARN BLEACH IN KLAUDER-WELDON DYEING MACHINE - 2 VOLUME BATH - 3½ LBS. STAR SILICATE PER 100 GAL. T= 130°F.

to the effect on the wool, is the initial costliness of the equipment, which should contain no metal that is affected by a hydrogen peroxide bleach liquor.

Fig. VIII shows the hydrogen peroxide and alkali curves of a Klauder Weldon machine bleach.

Bleach Control

In all hydrogen peroxide bleaching, reliable and easy chemical control is highly essential for uniformly good results. For wool bleaching, any standard permanganate solution may be used to control the peroxide. It is not, however, so easy to control the silicate. First of all, the standard acid solution used should be standardized against accurately known silicate peroxide solutions. Secondly, the indicator used should be standardized with known silicate peroxide acid solutions in order that the end point obtained will give the exact quantity of the particular silicate used. For instance, the use of a 59 deg. Be. silicate gives a different end point from the one obtained with a 42 deg. Be. silicate. The presence of chlorides, sulphates and phosphates in the hydrogen peroxide also affects the end point. Any difference in the commercial hydrogen peroxide solution used for bleaching necessitates somewhat different alkali control.

Spoilage

Properly scoured yarns put into properly bleach liquors in open kettles will produce little or no upward pressure. It should require only a small push on the top layer of yarn to move the entire batch. If yarn which has gone down easily presses very strongly against the cover at any time during the bleaching, either the hydrogen peroxide is decomposing rapidly or the bleaching is going on too quickly, so that an undue quantity of by-product oxygen gas is formed. Usually these two conditions will occur simultaneously. The result of such pressure is overbleaching, sometimes a breaking of the cover and tangling of the yarn, under bleaching of the top layer of yarn, undue consumption of peroxide.

At times scoured yarn, thrown into a properly prepared bleach kettle, does not sink and resists all efforts to push it down. In many cases a warm water rinse containing a small quantity of hydrapthal and a partial whizzing of the yarn will make it behave. In some cases an additional careful scour is necessary. Scoured yarn should always be tested for oil and should not be allowed to lie around for any length of time before being put into bleach.

When bleached yarn is removed from a kettle it should be examined for unevenness. Skeins not evenly bleached must be picked out before sulphuring and put back into bleach. An exhaust kettle, warmed to about 110 deg. Fahr., will in most cases even up this bleach. In severe cases of unevenness it is necessary to rebleach the entire batch of yarn, but care must be taken in preparing this bleach or the yarn may be overbleached, harshened and tendered.

Spots on bleached yarns may not always be due to uneven bleaching. Unscoured olive, lard or mineral oils produce yellow spots on yarn. Some mildews show up as yellowish streaks in bleached yarn. A scorch from a hot pipe or a sulphuric acid burn will show up yellow or light brown. A rust spot will become yellow in bleach even if the yarn is not tendered. Wet, bleached yarn has a tendency to take spots from paper, wood, iron, etc., with which it may come in contact, so that it should be carefully covered in transit.

The natural color removed from wool by the alkaline peroxide bleach is probably an acid color which remains in solution as long as the liquor is alkaline. Should it for any reason turn acid, spots of this color may go back on the yarn.

Whenever spots are noticed on bleached yarn, it is

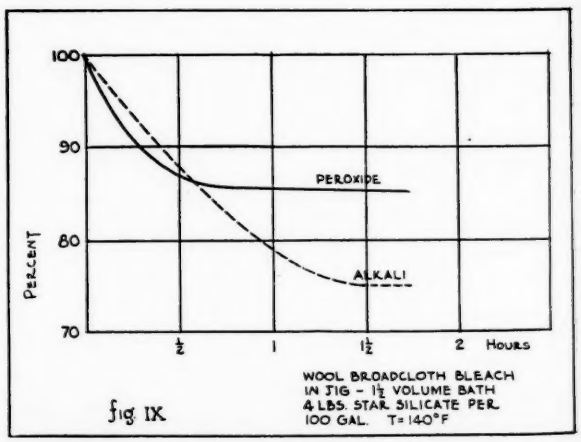

fig IX.

WOOL BROADCLOTH BLEACH IN JIG - 1½ VOLUME BATH 4 LBS. STAR SILICATE PER 100 GAL. T= 140°F

highly desirable that they be investigated thoroughly before any treatment is attempted. Otherwise the treatment may exaggerate or even make permanent the condition.

The presence of uncontrolled caustic, solid or liquid, in a bleach liquor almost always results in burns on the yarn. Metallic impurities such as rust, copper or zinc from brass pipes, soap balls due to hard water, etc., are a prevalent cause of burns in the peroxide bleaching of wool.

In the daily operation of a continuous kettle there should be little or no loss of peroxide and alkali while the liquor is idle between bleaches. Sometimes, however, a loss of peroxide alone or of both peroxide and alkali occurs in a standing liquor over the week-end or even during idleness of a few hours. This is especially likely to happen in old wood kettles.

If only the peroxide is dissipated, the destructive agent is probably a bacterial growth which seems to thrive in nearly neutral solutions of hydrogen peroxide, containing protein matter such as left behind by the wool. A microscopic examination of scrapings from the sides of the kettle at the water line will indicate bacteria if present. These can be destroyed by a thorough cleaning of the entire kettle, followed by a treatment with formaldehyde or carbolic acid.

If both the peroxide and alkali are dissipated, it is probable that the wood kettle has reached a stage of nonresistance in which any peroxide solution will continually act upon it. In such a case the kettle should be lined with either Monel metal or cement, or replaced entirely.

Catalytic destruction of a peroxide liquor by means of impurities that have fallen or been blown into a kettle can be detected by ordinary qualitative tests and acted upon accordingly.

Wide Fabrics

Wide wool fabrics are bleached in jigs, in machines through which the goods are slowly moved, in machines through which the bleach liquor is slowly moved, in standing kettles and in the ordinary piece goods washer. Everything previously mentioned in the bleaching of wool yarns applies to the bleaching of wool goods.

The quality of the yarns used in the manufacture of the goods and the strength of the bleach liquor determine the kind of bleach that may be obtained and the time required to obtain it. As a general rule, bleached goods do not look as white as the bleached yarns of which they are made.

Jig Operation.—The bleaching of fabrics in a jig is a process similar to the bleaching of yarn in a Klauder Weldon machine. The jig may be operated with a continuous liquor for an indefinite period. A temperature of 130 to 160 deg. Fahr. is maintained during the entire bleach. If advisable, additional wetting out materials which will improve the feel of the goods or decrease the bleaching time, may be added to the bleach liquor. Fig. IX shows the hydrogen peroxide and alkali curves of a jig bleach.

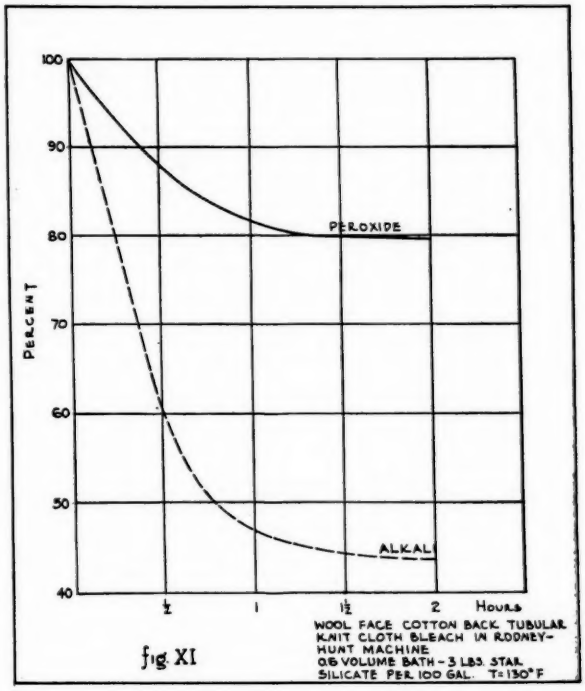

fig XI

Machine Operation.—(Goods in motion, liquor stationary.) Fabrics that cannot stand the tension of a jig are bleached in open machines by being slowly moved through an alkaline peroxide liquor. Both the liquor strength and the temperature are lower than in jig bleaching because the goods are immersed in the liquor a larger part of the bleaching time.

Machine Operation.—(Goods stationary, liquor in motion.) Fabrics that cannot be conveniently moved about in a machine are held down loosely by a suitable cover and the peroxide bleach liquor is made to circulate through them. The whole problem here is to get uniform bleaching, i. e., uniform circulation. This can be obtained only by a properly designed machine and by proper packing of the material before the liquor is admitted.

Standing Kettle Operation.—Fabrics that cannot be moved about at all and that cannot even stand the circulation of a bleach liquor through them are bleached by immersion in standing liquors that are usually quite weak in both peroxide and alkali. It is essential in this type of bleaching that the goods be laid or hung so as to prevent the formation of air pockets which can cause uneven bleaching. As only a light cover is used to hold the goods down, the liquor may be gently stirred from time to time to shake off the oxygen gas bubbles which retard the bleaching.

Piece Goods Washer Operation.—Wool cloth that can stand the squeezing and felting action of the washer for about an hour may be successfully bleached in a weak alkaline peroxide liquor. The purpose of this bleaching

is to clear up the white yarns of such cloth as tweeds, herringbones, flannels, etc. Fig. X shows the hydrogen peroxide and alkali curves of a washer bleach.

Upon removal from a hydrogen peroxide bleach, wool cloth should be finished in a sour bath (acetic or sulphuric acid) which may contain a blue tint. This not only brightens up the cloth and makes it look whiter, but also prevents the drying of any alkali within the fiber.

Narrow Fabrics

Narrow wool fabrics are ordinarily tubular knit cloth of various widths and weights, used for making bathing suits, underwear, dress goods and trimmings. Such fabrics are usually bleached with more or less success on a machine like the string washer. Very much better results may be obtained by adapting the string washer principle to a peroxide bleaching machine. Such a machine should contain a very short liquor, the shorter the better, provided undue rubbing of the folded goods is avoided. The use of a light squeeze roll often reduces the bleaching time considerably. Unless a continuous liquor is used, the goods may be scoured, bleached, soured and tinted in the same machine. Fig. XI shows the peroxide and alkali curves of a jersey cloth bleach.

Fabrics, wide or narrow, made of silk-wool, silk-rayon-wool, rayon-wool, silk-cotton-wool, rayon-cotton-wool, cotton-wool, are bleached in exactly the same manner as all wool fabrics. The strength of the bleach bath will vary with the composition of the cloth. The only rule that can be followed in the bleaching of wool mixed fabrics is that wool requires the most peroxide and can stand the least alkali of any fiber.

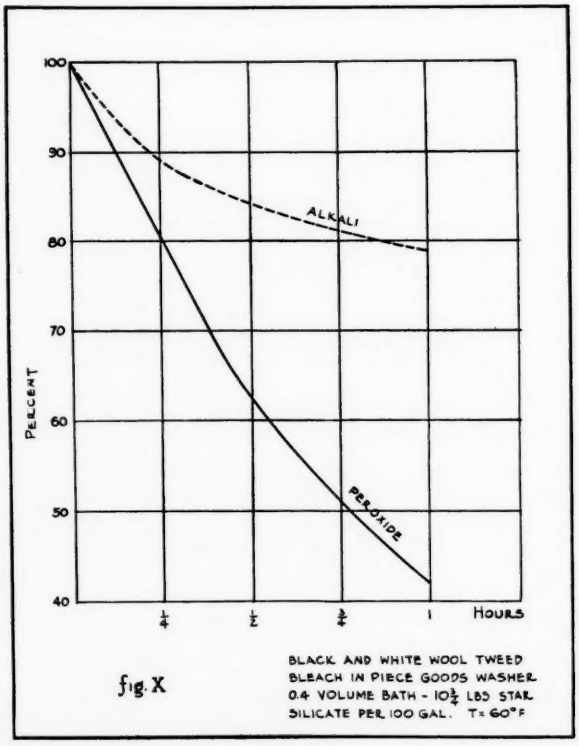

Fig. X

BLACK AND WHITE WOOL TWEED BLEACH IN PIECE GOODS WASHER 0.4 VOLUME BATH - 10¾ LBS STAR SILICATE PER 100 GAL. T= 60°F

Wool Hosiery

Wool hosiery is usually bleached by being thrown into a alkaline peroxide liquor of about the same composition as the wool yarn bath. Wool-silk and wool-rayon hosiery may, however, be bleached very successfully at a comparatively high temperature, for a short time, in the ordinary hosiery dyeing machine. Wool hosiery can be sulphured after a peroxide bleach, if a pure white is required. This is usually not advisable because the close contact with the skin of wearer may bring out the sulphuric acid. Bleached hosiery should always be scoured before drying.

The bleacher gets so many different kinds of wool goods from so many different sources, without any word of warning or explanation, that it is remarkable how well he ordinarily does his work.

To make it somewhat easier to locate the cause of trouble in bleaching he should keep complete records of every lot that passes through the bleach house, look out for wools that have been incorrectly carbonized, for wools that have been reworked from previously sulphured stock, for wools that have been stripped down from colored stock, for wools that have been spun too soft or too hard, and for wools that have been scorched or burned in some previous wet process or drying.

Whenever possible, it is a great help to make an experimental bleach test on the yarns of which a cloth is made. This gives a very good indication of the bleach to aim for in the piece.

NEW APPARATUS IMPROVES COLORIMETRIC TEST METHODS

A photocolorimeter recently perfected by a French inventor, M. Toussaint, renders color measurements independent of the eye, thus partly eliminating the human factor usually involved in colorimetric tests.

According to a description of the new instrument, color is determined by a curve having for abscissa the rays composing the color, and for ordinates the luminous intensity. The instrument comprises an ordinary photoelectric cell with a potassium cathode and an anode consisting of a tungsten ring connected through a cell to a galvanometer.

The light from the material under observation impinges on the potassium, which emits electrons that cause a variation in the intensity of the current in the circuit, thus providing a measure of the light intensity. In making tests six colors of the spectrum are used: the color being studied is compared with the standards, but the eye of the operator plays no part in the operation.

Proceedings of the American Association of Textile Chemists and Colorists

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NOVEMBER MEETING OF THE NEW YORK SECTION

The November meeting of the New York Section of the American Association of Textile Chemists and Colorists was held on Friday, November 25, at the Machinery Club, New York City. Forty-seven members and guests were present for dinner and about thirty more came for the meeting proper, which was called to order at 8.15 p. m. by Mr. Hayes.

The minutes of the October meeting were read and approved, the Treasurer's report was accepted and Mr. Herrman spoke of the plans of the Program Committee for the January meeting, promising a very interesting meeting on Hydrogen Ion Control. A. P. Howes told of arrangements that had been made for the annual meeting of the Association to be held in New York City December 2 and 3. It was regularly moved and seconded that the February meeting of the New York Section be held in Paterson and that a program of general interest to the silk industry be arranged. Mr. Hayes then introduced the speakers of the evening, who were P. J. Wood, E. W. Guiterman, Thomas R. Harris and Parker H. Del Plaine. Each of these gentlemen spoke in very interesting terms upon subjects allied to textile printing.

The Chairman's introduction, the addresses and papers and the discussions follow:

Chairman Hayes—If there is no other business to come before the meeting we will pass on to our technical program. I will say here that the speakers, of course, will be and are prepared to answer questions.

The task of the Chairman in introducing the first speaker is extremely easy. If there is any man in our Section who does not need an introduction, it is Mr. P. J. Wood. (Applause.)

The Art of Textile Printing

By P. J. WOOD
Oriental Silk Printing Company

Mr. Chairman and Gentlemen: If I might be permitted for one minute to refer to the very excellent talk of the Chairman of our Program Committee, I should like to say that from personal observation in this country I have noticed a decided and intimate relation between the Chinaman and the iron. (Laughter.)

In order to introduce my subject I should like to tell you how I came to speak here to-night. A few weeks ago the Chairman of the Program Committee in his persuasive and delightful way called me on the telephone

and gave me this assignment. He said, "We are going to have a sort of symposium on textile printing. Will you be willing to talk for a few minutes and introduce the subject?"

I didn't see any harm in that. I thought I could do that, without having to write a speech. So, in a weak moment, I said "Yes," and I see now that he has me marked down to give a dissertation on the art of textile printing, truly a large order. (Laughter.)

The Chairman tells me that I am not allowed to speak more than three and a half hours so I have decided to cut it down to about ten minutes, because it would be futile for me to attempt to cover this subject in the time at my disposal.

When the Chairman named this subject, "The Art of Textile Printing," I was wondering whether it should be the art or the science of textile printing, and then I decided that probably it was fifty-fifty, like the man who made the rabbit sausage in Chicago. I don't know whether all of you have heard this story. It is an old one.

The Government inspector came around to see this man one day and he said, "By the way, you seem to be selling a lot of this rabbit sausage."

"Yes, it is going very well," he said.

"Well," said the Government inspector, "isn't there some horse in that sausage?"

"Yes," he said, "there is some horse in it."

"How much?"

"Why," he said, "about fifty-fifty, one rabbit and one horse." (Laughter.)

On the other hand, there may be people who would describe textile printing as neither an art nor a science, but as a business, and probably it is all three. But I assure you that lately I would rather describe it as an art, for business presupposes the item of profit, which seems to be entirely lacking in our present day calculations in this industry. So I would say that more and more it is becoming art for art's sake. (Laughter.)

Early Origin of Printing

To come to our subject finally, it might be interesting to speculate on the origin of printing, or to talk a few minutes at least on the origin of textile printing. I think the actual beginning of textile printing is lost in the far and distant mists of antiquity. We imagine that it started in India a great many centuries ago. We find that one of the Roman writers refers to fabrics of multicolor which were made in Egypt. These may, of course, have been woven fabrics but, on the other hand, many have supposed that they were printed fabrics.

The method of producing multicolors on fabrics in India, probably the oldest method, was that of knot dyeing, or partial dyeing. The goods were knotted and tied or pressed between little metal disks or pieces of stone and then they were subjected to dyeing over some part of their surface. Multicolored effects were produced in this way. There are some very fine examples of this in the Newark Museum, and, of course, in the Metropolitan Museum of Art.

This most interesting process, of course, was very arduous work. These little knots were very carefully tied by women, generally—women usually get the hard things to do—and the dyeing was done by the men. This type of textile coloring, of course, is something which cannot be produced in large quantities, although it is astounding what very large pieces of work the Indians have been able to produce.

Then somebody evidently discovered that it was much easier to protect the fabric by painting with some resistant substance, and so there arose the art of wax printing or batik dyeing, as it is sometimes called. By this process melted wax is poured in the form of a design on the fabric and then the fabric is dyed one, two, or three times, or more, in various dyestuffs and multicolor effects are so produced.

About the first printing which came to Europe was a type of printing known as the Golgas Process, which was imported probably from India (at any rate, from the East) by the Hollanders, and from Holland this type of printing was very quickly adopted by many of the European countries.

In this method of printing, two pieces of perforated metal were used, in which the perforation corresponded, and the perforations were made in many different forms and designs. These were squeezed tightly together on either side of the fabric and clamped, and then the dyeing was done by dipping the protected fabric in the dye liquor. One of the styles which was probably most popular at the time of the introduction of this style into Europe was the Turkey Red discharged with chlorine. In other words, a piece of Turkey Red (I believe it was applied mainly to heavy cotton flannels) dyed flannel was clamped in this way and then subjected to the action of chlorine and the color bleached out. This gave a white on red and was probably the forerunner of the bandana, which, by the way, is an Indian word and shows the origin of the bandana style, which, as most of you know, was a red, white and black or red, white and yellow or red, black and yellow produced either by knotting or by this type of metal protector.

The Discovery of Block Printing

For some time this was the only process which had sway in Europe, but eventually the system of printing by wooden blocks was discovered. The origin of block printing is also lost. There seems to be no record as to

who produced this method. As most of you know, in this process of block printing, the blocks are cut out of wood and they are stamped on the color, on a sort of pad, and then transferred to the fabric—a very simple stamping process. It is very simple but requires a great deal of skill, of course, to get the exact degree of pressure and the exact amount of color on the block, to transfer it satisfactorily to the pieces, and, of course, to keep the piece goods clean and clear and produce a satisfactory impression. By this means a very crude but satisfactory multicolor effect was produced.

The next improvement was the introduction of brass wire into the blocks in order to produce finer effects, brass wire or plate set on edge. A sort of brass ribbon was pressed into the face of the block and was used to make fine stems, fine outlines, and various other effects. This was supplemented by brass pins which were cut off to the same length as the brass tape and the piece of the wooden block, and very beautiful effects were produced in that way.

A later method was that of casting type metal into the form. This process was used in letter press work, in the same way that the wooden block was used, and was very much more durable. It didn't split and it had the additional good quality of not absorbing the dyestuff. Many times the block printers have to bleach their blocks before they can use them for the next combination.

The latest development was the making of hollow type metal forms into which felt was introduced; the felt, having more absorbent qualities, picked up the color better and transferred it better to the fabric.

Development of the Block-Printing Machine

All this took place in the early and middle part of the eighteenth century. In 1790 a very radical departure was made from this old method of block printing, which resulted in a very much bigger possible production of printed fabrics. A man called Lichtenburger produced a block-printing machine. Just exactly what the form of that machine was, I have been unable to discover, but an improved (or what was supposed to be an improved) machine was made in 1834 by Perrot of Rouen. Rouen, of course, was a very celebrated printing center even in those days, and in 1834 Perrot produced what is now known as the Perrotine machine.

The Perrotine machine is a block press and is generally used for making handkerchiefs and squares. It consists of a large cube, around three sides of which are arranged the printing blocks, which can be pressed onto the block, and the goods are carried between the block and the printing surface. It seems to be a very crude way of doing work although there are a great many of them used even to-day in France. You can see them, I think, in Jouy and in Alsace; at least, they had them there in 1913 when I was there. I think they are probably using them to-day.

The big advantage of that system is that you get the effect of block printing, which gives very positive, deep and rich colors, and you get that "arty" look to the fabric, which is very often missing from roller-printed work, an effect which, by the way, during the last few years we have striven to imitate by means of rollers.

Bell's Roller-Printing Machine and Its Improvement

Up to that point everything had been done either by block or by the Golgas method or by Batik printing, or knot work. In 1785 a Scotchman named Bell made the first roller-printing machine—I might say the first successful roller-printing machine. Doubtless there were others who had made efforts to produce such a machine, but Bell was the first one who successfully printed cotton goods on rollers. He did this in the establishment of Lipson, Hargreaves & Hall, at Mossley in Manchester, so it is no wonder that Manchester is still probably the largest cotton printing center in the world. The industry had its birth there.

Bell's machine was rather crude and was susceptible to a great many improvements, and we find that in 1823 a man called Church took out a patent for a certain improvement, and Preston, in 1836, invented the endless blanket. Before that, the blanket had run through the hot tower or the drying apparatus along with the goods which, of course, as most printers would readily recognize is not a very practical way of doing it because it has a tendency to rub the blanket against the cloth and produce poor outlines.

Adam Parkinson made another improvement on the machine and I think I may say, without fear of contradiction, that there has been very little real improvement in the printing machine since that time. The men of those days built better than they knew. I suppose they thought their machine would be superseded in a very short time by something entirely different, but the machines we are using to-day are practically the same as the machine which was invented by Bell so many years ago, with the exception of some very small details of construction. I think, as a matter of fact, we have a machine in the mill that has been running since 1868, and alongside of the other machines it doesn't look so out of date, when it is painted up. (Laughter.)

A few other refinements and changes have been made. Of course, the main difference between the roller printing and the block printing is in the richness of colors. It isn't possible to get the depth of color, especially the richness, that can be obtained by printing the same block

two or three times over on the same fabric. We can't get that richness on the printing machine. And many men, of course, set their minds to work on printing as quickly with blocks as one can print with the regular roller machine.

It was in 1805, I think—probably it was a little earlier than that—that someone finally succeeded in printing with wooden rollers, relief rollers. With a relief roller, you have a very much better chance to penetrate the fiber better and, as I say, to get this heavy surplus of color that is required to produce these satisfactory, rich shades, and someone had conceived the idea of making these wooden relief rollers and printing them on the regular machine. Of course, that involved another little change in the machine; that is, the supplying of the color to the printing roller could not be done by means of a furnisher as in the case of the regular copper roller-printing machine, so they had to serve it with a blanket and quite a little ingenuity was expended in accomplishing this. But later in 1805, I. Burton, who was with Sir Robert Pell & Co., Ltd., at Church near Accrington in Lancashire, introduced a combination machine by means of which he could print with both types of rollers, and I think that is about the highest refinement to which the printing machine has been brought.

A few years ago I was in Lancashire and I went to visit my namesake, John Wood. I generally call to see the old man when I am there. He is about eighty-five years old and is still active in his business. He showed me a machine that he had recently invented which I think is an improvement over any relief machine that I have ever seen, inasmuch as it is possible by one move of the lever to remove all the printing rollers from the surface of the machine. Of course, when you have to screw down every roller, as in the old type of machine, it is quite a job to stop at noon-time or to stop to make any changes, or anything of that sort, but this one lever automatically, by means of a cam, removes all the rollers from the surface of the printing drum which, of course, is quite an accomplishment.

I think I have talked a little longer than I should have. I have been "sawing off" here for about twenty minutes. I hope, Mr. Chairman, that that introduces the subject satisfactorily. If there are any questions anyone would like to ask, I won't promise to answer them, but I will try. I think, however, I have paved the way for the other gentlemen who are anxious and willing to give you some real information. (Applause.)

Chairman Hayes—Are there any questions? Don't let Mr. Wood off that easily.

We will pass, then, to the next paper.

Amongst the trials and tribulations of any man in a print shop is the question of paste. There is always a desire to use the cheapest paste and the color mixer usually has some good reason why he shouldn't use that paste. In addition to the paste there is the question of the discharging agents which have come into play, in recent years particularly.

Our next paper will deal with the use of hydrosulphites in printing pastes. Parker H. Del Plaine, of Rohm & Haas Company, will present this paper. (Applause.)

Mr. Del Plaine—Mr. Chairman and Gentlemen: This is rather an awkward position to put me in, asking me to talk about the use of hydrosulphites in printing, because my main job has been the use of hydrosulphites and sulphoxylates in bleaching, hardly in printing. I shall tell you as best I can, however, about the use of the products that are made by our company in the printing paste.

. . . Mr. Del Plaine then presented his prepared paper:

The Use of Sulphoxylate Formaldehyde Compounds in Printing

By H. Parker Del Plaine
Rohm & Haas Company, Inc.

As you probably know, Schutzenberger first prepared the hydrosulphite in the solid state. In about 1900 when the vat dyes were first being put on the market, or being developed, and sodium hydrosulphite was beginning to be used in connection with the reduction of vats, Baumann, Thesmer and Frossard discovered the sulphoxylate compound at Zundel's Works in Moscow. Then they went back to Germany where they developed the use of the sulphoxylates as the vats were being developed by the Badische people.

Strictly speaking, no hydrosulphites are used for printing because they reduce immediately in the cold and produce an acid bisulphite which would sometimes be undesirable ($Na_2S_2O_4 + H_2O + O = 2NaHSO_3$). On the other hand, it was discovered about 1900 that the formaldehyde condensation product with hydrosulphites were much more stable. These hydrosulphite formaldehyde products, which we shall here call by their scientific name, formaldehyde sulphoxylates, may be heated to quite a high temperature without breaking down. They begin to reduce strongly at temperatures at or a little higher than 212 deg. Fahr. and do not yield any acid which would tender the goods. They are admirably adapted to printing for white or colored discharge work. The compound most commonly used and exclusively used on cotton is the sodium formaldehyde sulphoxylate ($NaHSO_2.CH_2O.2H_2O$). This comes on the market and is put out by various concerns as the Hydrosulphite AWC, Hydrolic and Formopon. This product is a white crystalline material having a molecular weight of 154. It is put on the market in lump, pea size or powder, and once in a while it is offered in liquid form, but in solu-

tion the sulphoxylate formaldehyde compounds undergo rapid deterioration, hence solutions have only a very limited application. Sodium sulphoxylate formaldehyde is soluble in cold water and much more readily in hot water. At room temperatures a 50 per cent, by volume, solution is easily obtained without crystallizing out which corresponds to about 8 pounds per gallon. The aqueous solution may be boiled in contact with air without losing much of its reducing value. However, if the solid sulphoxylate formaldehyde is left standing in a warm, moist, atmosphere, it gradually breaks down, giving off a strong and very disagreeable odor of sulphuretted formaldehyde.

I had an amusing experience in connection with this disagreeable odor, when I went down to visit a bleachery. They were bleaching cotton and silk stockings. They had trouble in getting some of the yellow off the stockings and the dyer said to me that the sulphoxylate wasn't much good. He said he knew he could get some from other concerns that was much better. He said, "I have a can of it here which I know is stronger than yours. Here, take a smell of it."

It was strong enough to knock one right over backwards. He said, "That shows yours is no good."

I offered to let him back up his truck in back of our dump and told him he could take away a carload if he wanted to, if that was the kind of stuff he wanted. In fact, that shows it is breaking down very rapidly and its reducing value is practically gone.

In the manufacture of Formopon most of the water of crystallization is driven off and the amount of water thus taken out is made up with sodium sulphite which acts as a stabilizer. Should too much water of crystallization be left the product would be very difficult to handle as it is apt to liquefy due to its low melting point, about 122 deg. Fahr.

Sodium sulphoxylate formaldehydes are used for white discharge styles of printing. The colors used must be totally reduced and destroyed by the sulphoxylates. A wide variety of such colors are obtainable that can be used for white discharges on cotton, wool and silk.

Use of Filters in Making Up Paste

The methods of making up printing pastes are numerous and varied, and I do not propose to give directions in that way except that it is necessary to get the sulphoxylate thoroughly dissolved and the paste thoroughly strained to take out grit or hard particles that may have been in the dye, the gums, color, or zinc oxide used. It is preferable to use a metallic filter cloth in place of the cotton filter cloth as the threads in a muslin cloth can easily be pushed apart or distorted, allowing particles of grit to easily work through. A metallic filter cloth has a very fine mesh and the fine threads in the webbing are rigid enough to prevent grit from working through. Where metallic filters are used there will be no trouble with scratching of the copper rolls or nicking of the doctor blade.

There was one printing concern that had considerable trouble with the making up of their pastes, especially with nicking of the doctor blades. They had quite a discussion about it because of the nicking. They discussed whether it was due to grit or whether it was due to some electrolytic action going on between the copper roller and the doctor blade. They adopted this metallic filter cloth, using a box, I should say, 2 or 3 feet in length and about the same in width, and they fitted that over another having a flange with rubber gaskets. They fitted the steam line so that there was a suction on the paste and they filtered their printing paste through this metallic cloth. This was done only in cases where they found they were obtaining scratches and nicks in their doctor blades.

After printing the goods must be thoroughly dried. The dried printed goods must not be exposed before steaming to the action of warm, moist air, as these sulphoxylate formaldehyde compounds which are quite stable in dry air, rapidly lose their properties in warm, moist air. Many imperfect discharges which are blamed on poor compounds are directly traceable to exposure of printed cloth to warm, moist air before steaming.

The steaming chamber, or ager, should be heated thoroughly before passing in cloth so that no moisture can come in contact with the printed cloth, as any moisture will cause running of colors and badly spotted goods.

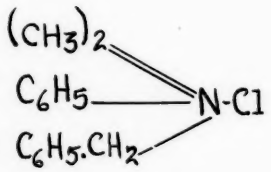
There must be an absence of air in the steaming chamber so that no oxidation of the reducing compound will take place.

When sodium sulphoxylate formaldehyde is used in color discharges the ground must be discharged and destroyed to a white, while the dye, making up the colored print, must be resistant to the reducing action of the sulphoxylate or come back on oxidation. The direct cotton colors and most acids can be used for white discharges while basics, mordants, vats and sulphurs can be used in color discharge work. Many printing formulas contain zinc oxide. This is not essential to the production of a complete discharge, but it enhances the brightness of the white considerably by covering the fibers with a white coating, a large part of which remains after washing.

Printing of Indigo and Indigoids

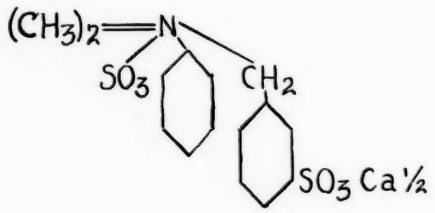
For the printing of Indigo and Indigoids two compounds are used in conjunction with formaldehyde sulphoxylate which give a white and yellow discharge with Indigo, namely, Indopon "O" for yellow discharge and Indopon "W" for white discharge.

Indopon "O" is dimethyl phenyl benzyl ammonium chloride:



It is used as a yellow discharge for Indigo. The principle involved in this process is briefly as follows: When Indopon "O" is brought in contact, in the presence of zinc oxide, with Indigo White produced in the fiber by the sulphoxylate discharge, it forms brilliant reddish yellow dyes which are fast to acids, alkalies, soaping and air, thus making permanent yellow discharge effects on Indigo dyed cloth.

Indopon "W," which is used for white discharges on Indigo, is made by sulphonating Indopon "O" and neutralizing with lime:



The principle involved in the use of Indopon "W" is that it combines with Indigo White previously formed by the sulphoxylate discharge to form a yellow dye which, while not being affected by air and moisture, is very soluble in alkalies, thus making it suitable for white discharges on Indigo and Indigoids by simply washing with alkali.

The important advantage over oxidizing discharges is that on the heaviest shades of Indigo a pure white discharge can be obtained without fear of tendering the cloth in the least degree.

Another sulphoxylate formaldehyde compound which is sometimes used in discharge printing on wool and silk is Protolin, a normal zinc sulphoxylate formaldehyde, $Zn<\begin{matrix}HSO_2.CH_2O)\\HSO_2.CH_2O)\end{matrix}$, a white crystalline powder with a molecular weight of 255. It is also soluble in water, but like the sodium salt breaks down in moist air, giving off a characteristic and disagreeable odor. The zinc sulphoxylate holds up much better in an acid paste at higher temperatures than the sodium salt and on breaking down forms zinc bisulphite and a little zinc sulphide which has great covering power, more so than zinc oxide, and leaves a brilliant white. For that reason this compound is a valuable product for occasional use where it is necessary to use a fairly strong acid discharge paste or where the alkali in the sodium salt may be harmful to the fabric.

Chairman Hayes—Are there any questions you would like to ask Mr. Del Plaine?

There is one feature of printing which is always a more or less unknown proposition, due to the fact that it is carried on behind steel doors; that is aging and steaming. We have with us to-night Mr. Guiterman, of the Sidney Blumenthal Company, who will speak to us on "Aging and Steaming of Printed Fabrics." Mr. Guiterman! (Applause.)

. . . Mr. Guiterman presented his prepared paper:

The Aging and Steaming of Printed Fabrics

By E. W. Guiterman
Sidney Blumenthal Company

In the seventeenth century the printed calicoes imported to Europe from India, variously known as Toiles Peintes, Chinz, Pintados, Indiennes, had become immensely popular as draperies, upholsteries and dress material. They were so much in demand by the fashionables of that that time that the business of the manufacturers of silk and woolen goods was seriously curtailed. These manufacturers made such a row about it that in the latter part of the seventeenth century France passed laws prohibiting their importation. By that time some information had been brought from India on the manufacture of these calicoes and among the plants that were built to imitate them was that of J. Deluze in Neufchatel in 1689. Then France put teeth into the law and also prohibited the printing of imported white cotton goods in imitation, fining and imprisoning those who had such goods in their possession and confiscating the goods. However, printers were producing them in Holland and in some of the free cities of Europe, and it was not difficult to smuggle them to the French. In spite of all the attempts at enforcement people insisted on using these goods and ultimately, about 1740, the law was repealed. I believe that a similar event took place in England.

Block printing and decorating of textiles, linen, wool and silk, with a brush and oil paints and gilt and silver, was done sporadically throughout Europe, chiefly in monasteries, as early as the thirteenth century. There are references to the existence of small block printing plants in England in the seventeenth century. From 1740 on block printing grew quite rapidly. In 1746 D. Koechlin with others established a block printing plant in Mulhouse, using oil colors; but in 1748, on information obtained from a printing establishment in Augsburg, they started to use alumina and iron mordants for subsequent dyeing with madder. The next important plant was established

in Jouy en Josas, Alsace, by a Swiss, Oberkampf, who later became a French citizen.

By this time the use of mordants for subsequent dyeing had become well established, and soon Oberkampf was producing large quantities of very beautiful imitations of the Indian prints. His establishment grew so large that he employed 700 or more hands, and for establishing such a profitable industry in France Louis XIV ennobled and decorated him. From printing by block, experimenters progressed to printing from engraved copper plates and later from engraved copper rollers made from sheet copper bent into shape with the edges soldered. The idea of the roller multiple printing machine gradually took shape, but it was not until 1783 that the first practical machine of six colors was produced by a Scotchman named Ball. The rollers from copper sheet were made by Fryer in 1764.

Development of the Roller Machine

The fame of the English roller printing machine was soon spread abroad, but it was not until 1801 that Oberkampf, with the assistance of Lefevre, who had worked in England, built the first machine on the Continent. He later built others and because of his great success in turning out such quantities of beautiful work he was for a long time credited with being the inventor. In 1811 print rollers were made by Fothergill by boring and turning copper blocks. So much for the development of printing.

The next process after block printing was the hanging of the printed goods usually in the same room where the printing was done. There the goods were allowed to hang until the print became dry enough to bear handling. Then they were hung in large chambers called stoves (étuves) in France, aging rooms in England, and allowed to hang for one to six days. These rooms were heated by flues from coal or wood furnaces. When the prints had been sufficiently aged they were dunged, washed and dried.

This method of fixing the mordants was not always satisfactory, especially on the Continent, where the air was much drier than in England; but even there they had trouble occasionally when it was very cold and dry. When this occurred the goods were again hung in the first room, where they must have absorbed more moisture, and then were again stoved. At that time exposure to heat and the oxygen of the air were supposed to be essentials for fixation. When the roller printing machine came into use, its much more rapid output made it necessary, in order to save space, to dry the goods at once; so they were run through hot rooms or over drying cylinders and came off perfectly dry, so the hanging was dispensed with, but not the subsequent stoving, which had been supposed to be the important part of the fixation.

Fixing of Mordants by Steaming Studied

It could not have been very long after roller printing was well established that it was recognized that moisture as well as heat was an essential in fixing the mordants. We find that the stoving or aging rooms were being built over streams or with reservoirs of water below the goods. Then they began to heat the rooms with steam coils and to supply moisture by allowing steam to escape into the chambers, though this last was not done until 1833 by Koechlin.

In 1828 Koechlin read a paper before the Societe Industrielle de Mulhouse describing his investigations, from which he deduced that in order to fix the mordants properly it was necessary to have a temperature of from 76 to 100 deg. Fahr. and sufficient moisture that there should be a difference of about 5 degrees between the wet and dry bulb thermometers. In 1917 we find the first mention of steaming printed goods by Bancroft. He steamed a bit of printed woolen goods wrapped in flannel over the steam from a boiling kettle for twenty minutes and had good results. Later Dollfus, believing that the heat of the stoving rooms fixed colors, endeavored to fix colors on printed wool by passing a heated iron over the prints, with disappointing results. Shortly thereafter he and Loffet made an experiment similar to Bancroft's and found the colors fixed by the steam from a boiling kettle.

From then on printed woolens and silks were steamed in a box placed on top of a boiler, the goods being carefully guarded against condensation. From this they progressed to the construction of a steam box of wood in which the goods were hung by their selvedges, a cover placed on top of the box and steam admitted from a pipe at the bottom. To prevent the dropping of condensed steam on the goods and for greater ease in handling, the box was provided with a peaked roof and a door at the side for the entry of the goods. From this construction the apparatus received the name of Cottage Steamer, which name has been handed on to its successors. This form was succeeded by a similar construction of iron. Before the present well-known cottage steamer came into being, made of boiler iron, cylindrical in shape, a similar construction was used, but having an elliptical cross-section instead of a circular.

We will leave steaming for the moment to go back to our aging rooms, large chambers heated to about 100 deg. Fahr. and with live steam supplying moisture. All processes now had to be speeded up to keep pace with the production of the roller-printing machine.

While it was now agreed that moisture as well as warmth was necessary for proper fixation, it was still believed that aging was essentially an oxidation. Thom, however, made the following experiment: He suspended printed swatches in atmospheres of pure gases, hydrogen in one case, oxygen and nitrogen. He found that in no case did he get proper fixation unless moisture also was present. Now, he wanted to hasten the aging process, so in 1849 he patented the first continuous ager. It was a small affair, shaped like the earlier cottage steamer, of wood, with a peaked roof. It had rollers top and bottom, over which the goods were drawn in full width under tension. There was a water well in the bottom, into which a pipe led live steam to heat the water to 180 degrees, at which temperature vapor is given off. Planks were laid over the well to protect the goods. This box held only 36 yards of goods. After running through the box, the goods were made into bundles and piled in a room kept at 80 degrees, where the aging was completed in one or two days instead of a maximum of six. The continuous ager, however, did not come into general use until Crum, in 1859, improved on Thom's patent by building a large room 48 feet long and 40 feet high, 11 feet wide, divided in half by a partition. Top and bottom driven rollers, steam coils to produce heat and openings for escaping steam to produce moisture completed the apparatus. The temperature was kept at 80 to 100 degrees and the moisture content was maintained to show 5 degrees less on the wet bulb thermometer.

This machine held 1,250 yards; the goods ran at 200 yards an hour and took fifteen minutes for passage. On emergence the goods were bundled and piled for completion of the aging. To increase its capacity, Crum's ager was sometimes modified by interrupting the progress of the goods in the middle of the box and allowing them to drop into a container, from which they were drawn over the balance of the rollers out of the box and bundled. This probably shortened the length of the subsequent aging in the bundle room.

Perfection of the Continuous Steamer

In the meantime coal-tar colors came into being and the production of Aniline Black on the fiber had been invented. In 1863 Mather and Platt produced their aniline ager very much in the form we know it to-day. With the production of stable hydrosulphites and development of the vat colors, it became necessary to modify the original rapid ager so as to exclude air, to have superheat in the case of the discharges and plenty of moisture in the case of the vat colors.

The boiler-shaped cottage steamer, while admirably fulfilling its purpose, was too slow to handle economically the enormous production of cotton prints. In 1875 Smith made the first continuous steamer somewhat in the form we have it to-day. This was greatly improved by Mather and Platt. In its perfected form to-day it consists of a brick chamber of a width sufficient to carry the widest goods, about 60 feet long and 60 feet high. There are steam coils in the bottom and at the sides to keep the temperature near 212 and a perforated steam pipe at the bottom to keep the box filled with steam; over the pipe is a false bottom to keep the goods from being wet by sudden spurts of water. The top of the chamber is made of a number of iron steam chests heated with steam—about 10 pounds pressure to prevent the condensation of the steam on the roof. Some 2 feet below the steam chests, inside the chamber on each side, is a rail on which the flanges of brass rods fit, the flanges of one rod touching the next. The rails are completely filled with rods, which are slowly pushed along by cams at the entering end of the steamer. Between the last two steam chests on top of the box, both front and back, are slots through which the goods in open width enter and are withdrawn.

As the goods drop down through the front slot, a rod is pushed forward and, touching the piece, it folds over the rod and is carried along looped over it; before the piece touches the bottom another rod comes forward and carries another loop. Thus all the rods are filled and the cloth travels slowly through the steam, taking from half to one hour from end to end. At the exit end of the steamer the piece is drawn out of the box and the rod is freed, picked up by hooks on each of two endless chains on each side of the box, and carried down to the bottom and so to the front and up to the entering end. Thus the rods do not leave the atmosphere of steam, no condensation will take place and they do not have to be handled. We have now three means of fixing colors: the continuous ager for Aniline Blacks, hydrosulphite discharges and vat colors; the cottage steamer for small quantities of goods and for steaming with pressure, and the continuous steamer for large production where pressure is not required.

Now, what does exposure to steam accomplish? In the case of printed metallic mordants, generally acetates of iron and alumina, the heat and moisture drive off the volatile acid and a basic salt or hydroxide is formed within the fiber. When dyestuffs mixed with mordants are printed and steamed, not only is the basic salt formed but the moisture in the steam dissolves little by little the dyestuff, which thus penetrates further into the fiber and under the influence of the continued heat and moisture combines with the mordant to form an insoluble lake.

When a color is printed on a fiber for which it has a natural chemical affinity, such as acid colors for wool and silk, the effect of steam and moisture is to produce an actual slow dyeing; the color paste, coming dry from the cylinders of the printing machine, is softened by the moisture in the steam and the small amount of dye dissolved in the moisture is absorbed by the fiber and the moisture then dissolves another minute amount, which in turn is taken up by the fiber until all the color is fixed.

In the case of basic colors mixed with tannin and acetic acid, the heat in the steamer drives off the acetic acid quite rapidly and the tannin color lake is formed, moisture again playing the part of a solvent. Aniline Blacks which can be developed on the cloth by heat alone also require the solvent action of moisture to aid the reaction by dissolving minute quantities of the ingredients, which prevents the excessive concentration of the liberated muriatic acid. In fact, the solvent action of moisture is needed to assist in all the fixation of colors.

What Is a Moist Steam?

The directions given by color manufacturers for aging or steaming generally say, "Steam for an hour as usual, without pressure or at so many pounds pressure, or age so many minutes with moist steam or very moist steam." What is moist steam or very moist steam? I have been endeavoring to solve that problem.

In the plant with which I am connected we have a small iron steam box built like a cottage steamer, 30 inches long and 18 inches in diameter, with a perforated steam pipe running the length of the box, a safety valve and an exhaust pipe at the back. The whole is well insulated excepting the door. I have made a series of tests with a few colors, acid, chrome and direct, on woolen and cotton goods, pile fabrics, to determine under what conditions to obtain the best results as to development and fixation of the color. The steam coming from the main line at 140 pounds was passed through a small separator and then admitted to the steam chest, and the pressure was regulated both by the valve controlling the inlet of the steam and the valve on the exhaust pipe. Thus, I could obtain pressure by allowing only sufficient high pressure steam to enter to maintain the pressure while the exhaust was entirely closed, or obtain the pressure by a very free flow of steam by leaving the exhaust wide open and allowing a greater inflow of high pressure steam.

With a separating calorimeter attached to the side of the steamer, I determined the amount of moisture under varying conditions and found the highest percentage of moisture in the steam when the steam was flowing freely through the exhaust. With the exhaust closed I obtained about 2 to 3 per cent moisture; with it open, from 4 to 6 per cent at varying pressures. I found with an acid blueprint on mohair that I obtained perfect development and fixation with two hours' steaming without pressure and with three-quarters of an hour's steaming at 8 pounds, exhaust wide open and the calorimeter showing 3 to 5 per cent moisture. Below that percentage the color would run on washing, while above 6 per cent moisture the color would run in the steamer but would be well fixed. The same held true for direct colors on both wool and cotton pile fabrics.

Our large cottage steamer is equipped with a safety valve, an exhaust pipe with valve and a drip pipe and valve, and the steam is led from the main at 140 pounds through a 2-inch pipe to the side of an upright iron cylinder 18 inches in diameter and 36 inches long, which acts as a separator, the water being drained off at the bottom. From this separator a 2-inch pipe takes the now dry steam from the top and passes through the valve of a temperature regulator connected with the steamer into the distributing pipe in the bottom. Tests for the moisture contents of the steam showed that when the boiler was filled with steam and the inlet valve open and all outlets closed, the steam in the pipe below the inlet valve contained at 140 pounds only 1 to 1½ per cent, but when the exhaust was open and steam flowed freely it contained 2 to 2½ per cent.

Tests of the steam in the separator showed practically no moisture. Tests of the steam in the steamer with outlets closed showed a moisture content of 1 to 1½ per cent; with exhaust open, 2½ per cent. This held true when pressure in the boiler was maintained at 5 to 10 pounds. When wool or mohair goods printed with acid colors were steamed at 8 pounds with exhaust closed, colors were not as well fixed as when steamed with exhaust open for the same length of time. I believe that the explanation lies in this: that when the steam flows freely containing 2 per cent moisture, a greater quantity of moisture is in contact with the goods than when there is but little flow. The printed goods are taken from the printing machine with practically no drying, are rolled up piece by piece, and when convenient are taken to the steaming room and hung by their selvedges in the steamer.

What I believe we should do is to start with dry goods for the sake of uniformity and with dry steam to which the necessary amount of moisture is to be added under absolute control. That has not yet been worked out. I want to find some way of exactly controlling the amount of moisture in the steam, and also some quicker way of determining the percentage of

moisture than can be done with the separating calorimeter, which takes ten minutes.

Discussion on Aging and Steaming

Chairman Hayes—Are there any questions you would like to ask Mr. Guiterman?

Question—I wonder if Mr. Guiterman differentiates between the terms "aging" and "steaming." In his talk he used those indiscriminately.

Mr. Guiterman—Yes. Aging, as we understand it now, is really a short steaming and it is done for the purpose, for instance, of developing Aniline Black, which requires only a minute or two; for developing vat colors, which will take anywhere from three to seven minutes, and for discharging dyed shades with hydrosulphite, which will take from two to five minutes. Steaming, on the other hand, is simply a longer process. The fixation of colors on cotton, such as basics with tannin, or the various chrome colors, or Alizarine with alumina and iron, requires an exposure to steam of anywhere from half an hour to an hour and a half, for thorough fixation, and the cottage steamer is used where colors not only require a length of time but also pressure to fully develop them.

Chairman Hayes—Are there any other questions?

I understood Mr. Guiterman to say that with a moisture content of 2 per cent he didn't get development, and with 5 per cent he did. On what class of colors was that experiment made? I didn't get that point. What character of dyestuffs were used?

Mr. Guiterman—It happened, in this instance, to be acid colors on wool.

Chairman Hayes—Was that with discharge?

Mr. Guiterman—No, direct print—an acid color printed with acetic acid.

Chairman Hayes—Are there any other questions you would like to ask Mr. Guiterman?

P. J. Wood—I think I can answer one of Mr. Guiterman's questions.

In steaming wool, I think a larger amount of moisture is necessary in the steam than in steaming cotton, for instance, or even silk, and I know it is a practice with some wool printers to wrap the goods to be steamed in gray cloth or cheesecloth, which has a certain moisture content. I think they pad them with a three-roll pad so they get a very slight proportion of moisture in the cloth. In that way I think you will get the moisture you require.

Mr. Guiterman—I am sure that that is quite true, Mr. Wood, but the wrapping up of the goods in moist cloth is a thing that we want to avoid, as long as we can get the results otherwise.

I want to say this: in making my experiments in the small way, I found that with 2 per cent of moisture the small swatches that I got out of the steam box were absolutely dry. With 5 per cent of moisture, they were quite damp and, of course, that showed that we obtained the same result that we would have had we wrapped the goods in damp cloth.

With regard to the fact that we get thorough fixation in our large cottage steamer with only 2 per cent of steam, it occurs to me the reason for that is this: that we are allowing a large volume of steam containing 2 per cent of moisture to flow through that very freely so that the steam is changed many times in the three-quarters of an hour that we have it there, and that amount of steam that contains only 2 per cent really carries a large quantity of moisture which is absorbed by the cloth.

Mr. Wood—It is a well-known fact that wool normally will absorb 11 per cent of moisture, and it can absorb even a greater amount without appearing at all damp, and it would seem to me that possibly you may be taking the printed goods directly from your hot drier and putting them in the steam. I would suggest that you try the experiment of allowing them to cool, or even blow a stream to cold air on them to allow them to absorb their natural quota of moisture before putting them in the steam box. That would be an interesting experiment.

Mr. Wolstenholm—Is it not a fact, Mr. Guiterman, that by first steaming your woolen goods for, say, a period of twenty-five minutes, then taking your steaming carriage out and leading them through air for possibly ten minutes, then giving them another twenty-five minutes' steam, you will get better results?

Mr. Guiterman—Well, I don't know that we would get better results, because we are getting good results now, but the reason I have brought this up is because I want to take dry steam and inject into that steam the amount of moisture that I believe is necessary, and I want to know some way of doing that. I think if I can solve that problem, I can always control my steaming.

Mr. Wolstenholm—It has been done at different times by entering a wet bath-pan into the bottom of the steamer, thereby creating so much more moisture, and that is helping somewhat in the fixation of the colors, especially in acid colors.

Mr. Guiterman—That is without the necessity of taking the goods out of the steam box?

Mr. Wolstenholm—Absolutely.

Mr. Guiterman—Has it been found that the goods are damp or moist when they come out of the steam box?

Mr. Wolstenholm—Yes, they are moist.

Mr. Guiterman—But there is no control.

Mr. Wolstenholm—That appertains only to woolens. You can't do that with silks. If you do that with silks, the color will run all over the silk.

D. P. Knowland—Can't you get a good steam engineer to build you the proper type of steam flow meter and solve your whole problem in that way? Your idea is

good, but with the proper kind of flow meter I think your problem would be solved.

Mr. Guiterman—Flow meter for what?

Mr. Knowland—For steam, to flow in, in the proper percentage. That is a steam engineer's job, not a printer's.

Mr. Guiterman—Yes, but I don't think they have ever tackled a job of that sort. Of course, I know we have flow meters by which we can measure the steam that we are producing from a boiler or the amount of steam that we are using, but that doesn't solve my problem. What I want is dry steam, and I want to put into that steam as much moisture as I require, and control that moisture—

Mr. Knowland—Control it through the flow meter. That is what I mean.

Mr. Guiterman—I guess I am not engineer enough to say as to that.

Mr. Knowland—That is a steam engineer's job; not yours.

Mr. Wood—It would seem to me that you could get a constant amount of moisture in steam by passing the steam through a stated amount of water before it entered the steam box, or as Mr. Wolstenholm suggests, you could have water in the bottom of your steam box and pass your steam through that. Then you could make your tests with your steam calorimeter and determine whether you were getting the proper proportion of moisture.

Another thing that occurred to me was this: Wouldn't it be possible to introduce some hygroscopic substance into the color mixture—glycerine, for instance—so that it would attract a certain amount of moisture during the cooling that I suggested before the steaming?

Mr. Guiterman—Well, we do do that. We have hygroscopic substances in the color partly for that reason and partly for the purpose of penetration.

With regard to the thought about putting a pan of water in the cottage steamer, I am not certain about that. You see, steam as it comes from the boiler is saturated steam; that is to say, it is of the same temperature as the water from which it is developed. There is saturated steam, as I understand it, and super-heated steam. Superheated steam will take up moisture until it becomes saturated, but saturated steam is able to take up a considerable amount, I believe up to 40 per cent of vapor, or of water, really, in a physical state of very fine division. That is the moisture that is playing a part in the steaming and aging, and I don't think any moisture will be taken up unless you blow steam through the reservoir, and I am afraid to do that with pressure, for fear of getting water onto the goods.

Chairman Hayes—Are there any further questions for Mr. Guiterman? I think he has opened up a very interesting point there?

The next paper covers the carrying agents which are used. The hydrosulphites which we heard described would be useless, the solutions would be too thin, unless there was some carrying agent. The development of the copper rollers would not have been possible without some paste, some gum, and we wouldn't be bothered with the problem of aging and steaming if we had no paste or gum. I am glad to call on Mr. Thomas R. Harris, of Herrick & Voight, who will present a paper on "Gums and Agglutinants for the Textile Printer."

Mr. Harris! (Applause.)

. . . Mr. Harris presented his prepared paper:

Gums and Agglutinants for the Textile Printer

By Thomas R. Harris
Herrick & Voight

The present day printing of textiles would be impossible were it not for the improvements which have been made in the materials available for preparing colors. Years ago, of the natural gums, only arabic and tragacanth were used as color thickeners, and among the gum substitutes starch and crude forms of British gum and dextrine. To-day the colorist can choose between making up his own natural gums or using specially prepared gums, and in the field of gum substitutes the British gums and dextrines are now offered in various forms of conversion and combinations of raw materials, so that no mixing or blending of starch thickeners is necessary.

Thickening materials can be separated into three general classes:

Natural Gums, which are dried exudations from trees, such as arabic, tragacanth and insoluble gums, which come into this market under various names;

Artificial Gums or Gum Substitutes, such as wheat, maize or corn, sago, tapioca and products made from them by conversion, namely, British gums and dextrines; and

Gum Tragacanth Substitutes, made from the seed of the Caroub Tree or St. John's Bread, also known as Locust Bean. These gums are used in one or more branches of the printing industry.

Before taking up particular varieties of thickening agents, it would be well to consider their general characteristics. Bearing this in mind, the color mixer chooses his material—either starch, British gum, dextrine, arabic prepared gums, tragacanth or mixtures—aiming to secure the results necessary in the work at hand. The wrong choice of a thickening agent can cause just as much trouble as a poor selection of dyestuff, or faulty engraving.

All thickenings are used for but one purpose, namely, to hold the dyestuff so that it may be applied to the cloth in the desired pattern. Therefore, the thickening must have the ability to hold the dyestuff, prevent it from

spreading, and allow it to penetrate the fibers to the necessary degree.

Action of Various Thickening Agents

The term "thickness" as applied to fluids is easily comprehended, but how various thickening agents act when mixed with watery fluids so as to communicate the property of thickness, is not so well understood. It is not a bad comparison to look upon water, when thickened with starch or gum, as if the water were fixed or deprived of its fluidity by being held in a fine spongy state. The common varieties of sponge differ greatly in fineness and in water imbibing and retaining powers, but the imagined spongy state of a starch or gum paste must be regarded as infinitely finer than any natural sponge, and as being flexible and mobile in its nature. If this hypothesis of the thickness of colors, being due to the diffusion of an insoluble, fibrous or gummy substance through the thin fluid be admitted, and if further the thickened mass be looked upon as a thin fluid held in a honeycombed texture, as water is held by a sponge, it will help us to understand the various qualities of different thickening agents.

The thickness of a mixture must not be confounded with its density, as when we attempt to compare the degree Twaddle of one gum with another. The indications of the hydrometer would show the relative weights of the material held in solution, and not its thickening qualities.

Actual viscosity is a better measure of the thickening value of any gum, but is not the final measure of the value of the thickening agent. The material to be printed, the pattern, and the nature of the work are the main determining features of what a thickener should be. It is evident that the thickening quality of a starch paste or tragacanth jelly is quite different from an arabic or prepared insoluble gum, and that they cannot be compared by any single apparatus or method.

In general, the color mixer in collaboration with the printer must decide the nature of his thickening; the color mixer to know what the ultimate result will be after washing and finishing the piece, and the printer, in turn, to know his engraving and the necessary sharpness of outline the design requires.

Where cheaper fabrics are printed and softness of finish is not a factor, starches of different varieties are the most economical and convenient for the color mixer to use. In the higher grade of printing, however, such as fine cotton voiles and silks, economy and convenience do not enter into the final result. It is in this field that the specially prepared gums find their largest use. Brilliancy of shade and penetration are the chief requisites in high-grade textile printing, and these results can be best secured with natural gums.

The starch thickenings are made from wheat, maize or corn, and tapioca. From these basic materials British gums and dextrines are manufactured.

As previously stated, starch is suitable for the rougher class of work where sharpness of line and detail is not of importance, where it is desirable to give weight to the finished cloth and softness is not necessary. It is hard to remove in washing unless enzymic agents are used.

Originally British gum was calcined or burned starch, and due to this treatment its thickening quality was very much cut down. Dextrine was starch treated with acid, with or without heat. British gums and dextrines of today are starches that are acid and heat treated to make them soluble. Light and dark dextrines and British gums differ chiefly in their degree of conversion, which factor also determines their solubility. Color may also depend on the material used in manufacture; a corn product being darker than a tapioca or corn and tapioca mixture.

With vat colors, starch, starch dextrine, or British gum dextrine thickeners are generally used. In recent years British gums or dextrines made from a tapioca base have been considered better for this work than when using a starch base, tapioca having a more fluid character than maize starches. On standing, a tapioca paste has less jelling tendency than maize dextrine. Also the tapioca products generally contain less dirt or insoluble matter, which is of importance in eliminating scratching and doctor blade troubles.

The Properties of Gums Compared

To illustrate, I have here the dirt and insoluble matter settled out of three different grades of British gums and dextrines on the market: No. 1 is considered better than the average dextrine, No. 2 a commercial British gum, and No. 3 a special high-grade tapioca British gum. You will note that the impurities from this last product are considerably lower than the others. This probably explains why its working qualities are superior, although I have seen or heard of this test being applied to show this.

Gum Arabic.—This is practically the oldest known gum for use in printing colors. It is generally bought in the dry form and boiled up in the color shop. As it contains a considerable amount of foreign matter, such as sand, bark and other gritty material, it becomes necessary to strain or settle out the boiled solution to remove these impurities.

Colors thickened with arabic yield very fine, level prints of a lighter shade than when starch is used. This because, in washing, the gum is more easily removed from the cloth. Its penetrating quality is good on practically all classes of fibers.

Its disadvantages are chiefly its stickiness, tendency to foam in the color boxes, and hardness of feel of the

finished print. Unless carefully prepared and all grit removed, this gum produces scratches, necessitating frequent filing of the doctor blades. It requires warm water for washing to remove the last traces of gum. It thins down rapidly on the addition of dyestuff solution, mordants or hydrosulphite solutions. In other words, its lack of holding qualities is a very undesirable feature.

Prepared Printing Gums.—These gums are made from insoluble gums which come into the market under various names, such names, as a rule, being derived from either the country of origin or the point of shipment. These insoluble gums are made soluble, cleaned and delivered ready for use. As the different kinds of gum require different treatment, and as different lots of gum vary in their characteristics, no set rule can be laid down for their handling. This is one of the main reasons why these gums are seldom prepared in a print works, since the person responsible for their preparation must, from long experience, be able to judge just what treatment is required to produce a material of good working properties. After the gum is made soluble, it is cleaned to remove bark, sand, grit and other impurities, and then sold either in paste or dry form.

The dry gums contain more dirt and grit than the paste products, and, furthermore, the cost of drying the gum and then making it up again into liquid form in the color shop is higher than the price at which liquid gums are now available ready for use.

The insoluble gums are generally used by silk printers and also for finer classes of cotton printing. With all classes of work they give an exceptionally sharp mark, do not gum or stick to the copper rollers, produce practically no foaming, yield bright, transparent colors, and wash out very easily.

Prepared Gums and Arabic

The question is often raised why these gums are preferable to arabic. Prepared gums with a solid matter content of about 30 per cent have a better body than an arabic gum of about 50 per cent dry matter. Prepared gums of 50 per cent solid matter give a paste of such good consistency that the color mixer is allowed ample leeway in dissolving his dyestuffs. This means less solid matter dried on the cloth and, accordingly, less and easier washing to remove the thickening agent.

A further advantage of these gums is that a manufacturer preparing them on a large scale can devote the time and attention to uniformity in consistency and purity. With a staff of trained men and the necessary equipment, he is in a position to offer these gums at prices much lower than they could be produced in an individual color shop.

A great improvement has been made in these gums in the last few years. Originally, in strength they were but little stronger than a 50 per cent arabic solution, whereas to-day concentrated gums are sold which would be equal to a gum containing from 80 to 90 per cent of dry arabic. Furthermore, they thin down much more slowly than an arabic gum.

In using these prepared gums no time need be spent in boiling, straining or settling gum. The material is ready for use, free from grit and impurities and of uniform strength. Uniform colors can be made; scratching and doctor-blade troubles due to impurities in the thickening material are reduced to a minimum. This means greater production and a marked reduction in the percentage of seconds.

To illustrate my previous remarks on dilution, I have had viscosity tests made with a standardized pipette and at fixxed temperatures. The following figures show the relative solution of the various gums:

Gum arabic 50 per cent.....dilution 1 to 1— 38 sec.
Regular gum .....dilution 1 to 1—109 sec.
Concentrated prepared paste..dilution 1 to 1—373 sec.

Gum Tragacanth.—This gum has the greatest swelling property of any known thickening agent and is widely used in the printing industry. It comes into the market in various grades and its price depends mainly on its color and freedom from impurities, such as bark, grit and other insoluble matter.

A good, clean, light colored gum is the best money value. This because such gum has higher thickening properties than the lower grades of coarse, dark colored gums, and because the lower grade gums contain considerably more sand and impurities, which are practically impossible to remove after the gum is boiled up. Practical trials often show that to secure a desired thickness it would take 2 pounds of a gum selling at, say, 55 cents per pound to produce a jelly of equal consistency with that made with 1 pound of a gum costing 85 cents per pound. Yet we find that in many cases tragacanth is bought and sold on looks alone. The color mixer is not consulted, but does receive the blame because, in a given period of time, in dollars and cents he consumes more gum than he did in a previous given period. This is generally not his fault, as the material he was given to work with did not have the thickening qualities and it was necessary for him to use more dry gum in order to get the required mark when printing.

Importance of Testing Tragacanth

If in buying tragacanth the purchasing department would test the samples offered for their thickening properties, much money would be saved. I have often

seen three or four lots of gum which on looks alone would appear to be equal and their prices were the same, but in their working qualities there would be a difference of anywhere from 10 to 30 per cent in value.

It is hardly necessary to say much about the working qualities of a tragacanth gum. It can be used for blotches, but does not give a good, sharp mark; for such purposes a starch, arabic or prepared gum is necessary. It washes out readily and, owing to the small amount of solid matter in the thickening material, gives exceptionally transparent colors.

Caroub or Locust Gum.—This gum is prepared from the seed of the Caroub Tree, or St. John's Bread; also called Locust Bean. Owing to the high price of gum tragacanth and because to-day the Caroub gums are being offered in an improved form, they are now being widely used.

That this is a gum which has been known for a long time is attested by the fact that an English patent for its preparation and use was granted in 1823. However, it is only within recent years that it has been offered in the form now available.

This material is made from a small seed which is enclosed in a hard, flinty shell. This was originally ground and delivered in a form similar to the sample which I have here. When boiled up, the gum-forming substance was dissolved and released from the shell. As the shell was insoluble, it remained in the gum and presented considerable difficulty in its removal. To show what this looks like, I have here a sample of such a gum unstrained.

The newer forms of these gums now on the market not only are practically free from this shell, but have probably been treated in some manner to make them more soluble. I say this because between the different varieties there is a considerable difference in their wetting-out properties, some being practically impossible to wet out unless stirred cold for five or six hours, whereas others wet out in less than an hour.

In thickening properties these gums are superior to tragacanth, in that about 1 pound is equivalent to 2 pounds of tragacanth. The newer and better products can be wet out and boiled up in about one to two hours' time and yield a clean, white gum.

The working qualities are similar to tragacanth, but colors printed with it are brighter and fuller. It is especially suitable for chrome colors on cotton, leaving them very soft.

These gums are being widely used for printing cotton draperies, dress goods and all classes of work not calling for a too definite outline. When used in admixtures with starches, British gums or dextrines, it facilitates the removal of these gums in washing, as compared when used alone, and does not in any way reduce the sharpness of the mark. Although easily removed in washing, it is very suitable for work which cannot be washed, such as screen printing, yarn and warp printing.

I have here samples, both in dry form and cooked up in a 2 per cent solution, of one of these gums now offered on the market and also a sample of 2 per cent tragacanth solution to show the difference in the consistency of these gums on an equal basis of dry matter.

Considering their purity and readiness with which these gums can be prepared, they are worthy of consideration by all users of gums of this nature.

Discussion on Gums for the Textile Printer

Chairman Hayes—Are there any questions for Mr. Harris?

J. J. Sokolinski—I should like to ask Mr. Harris how those samples were heated; I mean, the samples he is passing around. Were they heated on an open flame?

Mr. Harris—No, they were heated in a copper-jacketed kettle.

In talking to some of the dextrine manufacturers I found that a lot of that is carbon, and the carbon, I understand, is formed more or less by heat. This sample (indicating), I was told by the manufacturer, although sold to a large extent is never sold to anyone who isn't going to strain it pretty well, and they have never made any particular effort to see that there was no carbon in it; whereas this other product (indicating) is made with particular effort to control the temperature and prevent carbon forming in the manufacture.

Mr. Sokolinski—We handle many different grades of dextrines and starches, and a thing like that is very unusual. Carbon as dark as that really shouldn't exist.

Mr. Harris—It is a commercial product, widely used, and a well-known product, too.

Chairman Hayes—Are there any further questions?

Mr. Guiterman—I should like to ask Mr. Harris how gum tragacanth solutions should be prepared and printed.

Mr. Harris—As I understand it, the gum tragacanth is generally soaked up for a period of 24 hours, and then boiled for about five or six hours, until it is thoroughly dissolved in a copper-jacketed kettle. You can boil it too long and destroy your thickening qualities, and if you don't boil it long enough you don't get the full value out of the gum.

Chairman Hayes—Are there any further questions for Mr. Harris?

I feel we have all been admirably repaid for coming here to-night. We have had four very interesting papers and four papers which showed that the speakers gave a great deal of time and thought to getting them up. On behalf of the Section, I want to express our thanks for their papers and the trouble they went to in preparing

them, and in adjourning this meeting I should like to call for a rising vote of thanks to the speakers.

. . . The motion was unanimously carried by a rising vote that the speakers of the evening be extended a vote of thanks. (Applause.)

. . . The meeting adjourned at 10.20.

February Meeting of Rhode Island Section

The February meeting of the Rhode Island Section will be a joint meeting with the Rhode Island Section of the American Chemical Society held in the auditorium of the Jesse Metcalf Laboratory, Brown University, Friday, February 10, 1928, at 8.15 p. m.

An informal dinner will be held at the Brown University Faculty Club, 13 Brown Street, at 6.30 p. m.

The speaker will be M. J. Rentschler, general manager and director of the J. H. R. Products Company, Willoughby, Ohio, the largest manufacturers of peroxide products in the United States. His subject will be "The Peroxides, Their Manufacture, Properties and Practical Uses."

Mr. Rentschler was graduated from Pennsylvania State College in 1908 with the Degree of Master of Arts, since which time he has been an instructor there, studied in Germany, and has been connected successively with the Oakland Chemical Company, the U. S. Rubber Company and the J. H. R. Products Company.

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List of Products Manufactured by Grasselli Dyestuff Corporation

Owing to the fact that there was a misunderstanding in connection with the list of Grasselli dyestuffs as tabulated in the 1927 Year Book, we are publishing this list as of December 17, 1927, as representing the complete list of products manufactured by the Grasselli Dyestuff Corporation. These dyestuffs are sold by the General Dyestuff Corporation:

Acetine
Acid Alizarine Black SE
Acid Alizarine Brown N4R
Acid Alizarine Brown 5R
Acid Alizarine Garnet RA
Acid Alizarine Violet BA
Acid Anthracene Brown B
Acid Anthracene Brown RHA Extra
Acid Black NB
Acid Chrome Blue 3BA
Acid Chrome Green NC
Acid Violet S4B
Alizarine Astrole B
Alizarine Blue Black BA
Alizarine Blue Black 3BA
Alizarine Blue SAE
Alizarine Blue SAP
Alizarine Blue SAPR
Alizarine Blue SAPX
Alizarine Blue SKY
Alizarine Blue WSA
Alizarine Emeraldole GA
Alizarine Green CEF
Alizarine Green CG Extra
Alizarine Rubinole 3G
Alizarine Rubinole GW
Alizarine Rubinole R
Alizarine Yellow 5G
Alizarine Yellow GGW Pdr.
Alizarine Yellow 2G Pdr.
Alizarine Yellow 2GX
Alizarine Yellow R Pst. Special for Printing
Alizarine Yellow R Pdr.
Alizarine Yellow RW Pst.
Alkali Blue Paste 100%
Anthracene Yellow CA
Anthracyanine Brown GLA and RLA
Anthracyanine Green BLA
Anthracyanine Green 3GLA
Anthraquinone Paste 30%
Azo Brilliant Black AC
Azo Crimson L
Azo Fuchsine 6B

Proceedings of the American Association of Textile Chemists and Colorists

Azo Fuchsine 6B Ex. Conc.
Azo Fuchsine GA
Azo Naphthol Red B
Azo Phloxine GA
Azo Rubine
Benzo Bordeaux 6BA
Benzo Brown D3GA
Benzo Dark Green BA
Benzo Fast Black LA
Benzo Fast Blue FFL
Benzo Fast Brown GRA
Benzo Fast Brown GRD
Benzo Green C
Benzo Orange R
Bismarck Brown B
Bismarck Brown B Base
Bismarck Brown 2RN
Bismarck Brown 3RN Conc.
Bismarck Brown TSS
Bismarck Brown TSS Base
Brilliant Alizarine Blue GA
Brilliant Croceine 3B
Brilliant Croceine 3BA
Brilliant Lake Red R
Carmoisine BA
Chrome Black A
Chrome Yellow 2R Pdr.
Chrome Yellow SS
Chrysoidine NS
Chrysoidine RS
Chrysoidine 2RS
Chrysoidine Y Base
Chrysoidine Y Extra
Cloth Red BCA
Cloth Red BN Conc.
Cloth Red GA
Congo Corinth GA
Diamine Fast Red FC
Diaminogene Blue NAA
Diamond Black EA
Diamond Black ET
Diamond Black FA
Diamond Black PVA
Diamond Black PV Conc.
Diamond Black PVT
Diamond Blue Black EB
Diamond Blue Black RBN
Diamond Blue Black RBN Conc.
Diamond Fast Purple B
Diamond Flavine GA
Diamond Green 3GA
Diamond Red BHA
Diamond Red ECB
Diazo Black BHN Extra
Diazo Indigo Blue 4RLA
Direct Black DC
Direct Brown G
Direct Deep Black EA Extra
Direct Deep Black EA Extra Conc.
Direct Deep Black RW Extra
Direct Fast Brown M
Erythrine
Fast Acid Blue CM
Fast Brown R
Fast Light Orange GA
Fast Light Yellow 2G
Fast Light Yellow 3G
Fast Red A
Fast Red PAL
Fast Red PAT
Fast Sulphon Black A
Immedial Carbon RR
Indanthrene Brown R Paste
Indanthrene Brown R Pdr.
Indian Brown 3G
Indian Yellow GA
Induline Base B Fine
Induline Base 5B
Induline Base R
Induline 2B
Induline 2BASS
Induline 5B
Induline R
Induline Spirit Soluble
Katigen Brilliant Blue G Extra Conc.
Katigen Brilliant Blue RCL Extra
Katigen Brilliant Green G Extra
Katigen Brilliant Green 2GD New
Katigen Brown GR
Katigen Brown W Conc.
Katigen Brown K
Katigen Brown C3R
Katigen Crossdye Green B
Katigen Crossdye Green G
Katigen Cutch 2R Extra
Katigen Cutch Brown RN Conc.
Katigen Deep Black GGN Conc.
Katigen Deep Black LNR Extra Conc.
Katigen Deep Black N Extra Conc.
Katigen Deep Black RGN Conc.
Katigen Deep Black RN Conc.
Katigen Deep Black RR Conc.
Katigen Deep Black TN Extra Conc.
Katigen Deep Black WR Extra
Katigen Direct Blue B Extra Conc.
Katigen Fast Orange YSX
Katigen Green 2B
Katigen Green 2BF
Katigen Red Brown 6RN
Katigen Red Brown 9RN
Katigen Red Brown R
Katigen Tan G
Katigen Tan R
Katigen Yellow BG Extra
Katigen Yellow Brown 2RN Extra
Katigen Yellow GG Extra
Katigen Yellow 4C
Metanile Yellow
Monochrome Brown BC Conc.
Monopole Brilliant Oil Conc.
Naphthol AS
Naphthol AS-BO
Naphthol AS-BR
Naphthol AS-D
Naphthol AS-RL
Naphthol AS-SW
Naphthol Yellow S
Naphthylamine Black A4B
Naphthylamine Black 4BK
Naphthylamine Black 8B
Naphthylamine Black 10BD
Naphthylamine Black 10B Conc.
Naphthylamine Black D
Nekal A Dry
Nekal B Extra
Nekal BX
Nigrosine AK
Nigrosine BL
Nigrosine Base FB
Nigrosine Base NB
Nigrosine Base R
Nigrosine D
Nigrosine DGY
Nigrosine DP
Nigrosine ES
Nigrosine J
Nigrosine P
Nigrosine P for Silk
Nigrosine RB
Orange ES
Pigment for Lake C Paste 30%
Pigment Red R Paste 30%
Pigment Rubine G
Pigment Scarlet 3B
Pluto Orange GR
Ponceau G
Red for Lake C Paste 20%
Red for Lake C Powder
Resorcine Brown G
Resorcine Brown NA
Scarlet 2R
Scarlet 4R
Scarlet 2RO
Spirit Nigrosine Jet 5223
Spirit Nigrosine NB
Spirit Nigrosine RL
Spirit Nigrosine SSB
Sulphon Acid Blue BA
Sulphon Acid Blue RA
Sulphon Black RA
Sulphon Cyanine 2BA
Sulphon Cyanine Black BA
Sulphon Cyanine Black J
Sulphon Cyanine Black JB
Sulphon Cyanine GRA Extra
Sulphon Cyanine 5RA
Sulphon Cyanine 3RD
Sulphur Black GAC
Sulphur Fast Yellow G
Sulphur Khaki No. 40 Double Conc.
Sulphur Olive G Powder
Sulphur Olive Drab SY
Supramine Red 3BA
Tartrazine SEA
Tetrapole
Universal Black No. 4
Victoria Fast Violet 2RA
Victoria Navy Blue LHA
Wool Green BSNA
Zambesi Black DA

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
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Published biweekly by
HOWES PUBLISHING CO., INC.
90 William Street, New York City

A. P. HOWES, *President* E. S. PREDMORE, *Secretary*

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00

Vol. XVII February 6, 1928 No. 2

AN ISSUE NOT TO BE SHELVED

WHENEVER the days drag by too wearily in the Senate Chamber it is to be expected that a group of the more jaded members will try to enliven the program with a good old-fashioned tariff wrangle. There are always a few who persist in making history repeat itself, just for the sake of Senatorial tradition. Not a session passes but what some Congressman creates front-page news with a rash recommendation for tariff reduction. So accustomed have business men become to these periodic sham attacks on the tariff that there is some danger of their being caught off guard when a really serious attack is sprung.

The most recent tariff debate in the Senate was evidently another one of those born of the need for harmless diversion. Opened by Senator McMasters, of South Dakota, with a resolution declaring for a general reduction of the import schedules—which was promptly contested by Senator Smoot—it progressed through a week or so of interesting discussion in both Senate and House. The plight of the farmers was, of course, referred to more than once in the pleas for downward revision of duties. But the idea of a blanket tariff reduction was generally unpopular in both Republican and Democratic circles, where a moderate revision of certain rates is always the more acceptable suggestion. One or two members of the House even had the temerity to declare that rates on some commodities should be raised. Perhaps they were thinking of some of the higher type imported dyes—who knows?

Anyway, the McMasters resolution came to an untimely grief in the House of Representatives with a vote of 183 opposed to over 164 in favor of general tariff reduction. Experienced observers thereafter expressed the conviction that business need fear no alarming move on the part of the low-tariff group in the present session of Congress.

However reassuring such confidence may sound to American industry in general, and to the dyestuff and chemical industry in particular, the fact must be kept in mind that the strongest supporter of the protective tariff—President Coolidge—will most likely be whittling in Vermont next year. It gives but temporary comfort to know that in his address to the Union League Club of Philadelphia last November the President, shrewdly anticipating some agitation for tariff revision, rebuked those who might have been scheming to that end. "Any material reduction in our general tariff rates," he said, "would ultimately result in a drastic deflation of agricultural and industrial values, in the rate of wages and in the standards of living."

But it would be dangerous optimism to believe that the issue is dead for long. The same old uncertainty will make itself felt, if not this winter, then next fall, when Congress may stage more than a sham battle over the tariff rates. To quote from a recent business review by August Merz, president of the Synthetic Organic Chemical Manufacturers' Association:

> "The prospects for next year appear to be good unless tariff revision becomes the football of our politicians. President Edgerton of the National Association of Manufacturers recently stated that business could far better weather a calamity than uncertainty. If tariff revision becomes the subject of Congressional attention in 1928, the prospects of good business will rapidly vanish.

Obviously, it will be displaying only sensible caution to keep alive the subject of tariff protection wherever dyestuff manufacturers gather during the coming year. On that issue as on no other the position of the industry must be clearly understood by all. Every effort to clarify tariff questions relating to the dyestuff schedules should be encouraged and it would be well to keep sympathetic Congressmen informed as to the reasons for the industry's position.

OUR UNDEVELOPED CHEMICAL TRADE

NO American industry—nor, for that matter, any European industry—has ever been content to supply merely the demands of its home trade. But few industries have developed their plant facilities to the point of such capacity for overproduction—in relation to home consumption—as the American dye and chemical industry. This over-development has naturally tended to awaken among some of our manufacturers a lively interest in foreign markets for their surplus chemical products. The necessity for finding new outlets for surplus grows, in fact, with the competition in domestic markets.

The most effective means of increasing our chemical export trade will therefore be among the major subjects on the program due for serious discussion at the meeting of chemical executives to be held in Wash-

ington next week by the Department of Commerce and the Chemical Advisory Committee. Those who attend will hear the reports and valuable suggestions of trade commissioners who have made a thorough study of European and other foreign markets for chemicals. In addition, the facilities for securing reliable information on these markets will be explained by members of the Chemical Division of the Bureau of Foreign and Domestic Commerce.

In Europe we have, paradoxically, not only our most formidable competitors in the chemical field, but also our most profitable markets. According to Dr. Julius Klein, the annual exports of American chemicals to the Continent at present are valued at approximately sixty-two million dollars. Though imposing at first glance, this figure is deceptive, for it shrinks to comparative insignificance when we learn from Dr. Klein that, whereas we export from 7 to 9 per cent of our chemical production, our competitors—Germany, England and France—export from 25 to 33 per cent of their production.

England is our largest market, taking nearly one-fifth of all our chemical exports and purchasing more coal-tar products from us than any other country. Even Germany, with its powerfully organized plant and distributing facilities, and with a capacity for production that could probably supply the world's chemical needs, imports American chemicals valued at more than twelve millions of dollars; about half of this figure covers purchases of rosin and turpentine. Germany ranks second as an important European market for our chemicals. Six other European countries—France, The Netherlands, Belgium, Spain, Italy and Sweden—are prominent among those on our export lists.

The second largest share of the total chemical export trade of the United States is consumed by our neighbors, Canada, Mexico, Central America and the West Indies. In these markets we dispose of at least 27 per cent of our exports of chemicals, aggregating forty-seven millions. The total in 1926 was one-third larger than that for 1922. Canada alone imports American coal-tar dyes, colors and stains worth a million dollars.

From reports of trade commissioners issued by the Bureau of Foreign and Domestic Commerce, however, it is evident that in spite of our present lucrative trade we should be able to cultivate our chemical markets to an even greater extent, judging by the amount of this business controlled by European manufacturers.

We therefore see that the possibilities for expanding this trade are far greater than many of our chemical manufacturers suppose. This is one of the reasons that the chemical executive meetings are of such practical importance to the industry: any discussion of our export trade ought to reveal many new avenues of approach to those foreign markets, in which we must dispose of an ever-increasing amount of our chemical products if American plants are to be operated at the highest efficiency.

THE NEW AGE OF COLOR

(*An Editorial from the Saturday Evening Post.*)

THE effects of our chromatic revolution are everywhere apparent. Architects no longer hesitate to gild the outside metal work of public buildings, and most observers who have noted how cheerily the goldwork blazes in the morning sun hope the practice will never be discontinued. There is an increasing tendency to employ color, as the ancient Greeks did, in the external embellishment of buildings. Everyone who sees sumptuously staged spectacles and revues must have been impressed both by the new color sense characteristic of the best contemporary scene painting and by the unprecedented beauty of the costumes. The dyeing of textiles, whether for stage use or common wear, has made prodigious advances and every familiar color has been transformed by some small but vital change which has imparted to it new life, charm and interest.

One need not leave his own fireside to observe equally striking signs of the new invasion. Hangings, draperies and floor coverings tell the same new story. The craze for colored glassware for table and parlor use has produced new hues and effects. Even the humble agateware of pantry and kitchen refuse to be denied a part in the general symphony of color. Motor cars are borrowing their hues from the waters of the Nile, from the sands of Arabia, the plumage of birds and the fire of gems. Everything that woman wears shares the new legacy of color.

Neither progressive manufacturers nor a receptive public can claim the greater share of credit for ushering in our new age of color. This must be assigned to our chemists, laboratory men and researchers. They have worked so quietly and so obscurely that we scarcely realize what a variety of new substances and materials of which to make articles of common use they have brought into being. It is characteristic of many of these new products that they are light, strong and susceptible of a bland polish. Moreover, they can be permanently and artistically colored.

Again we must thank the chemists for liberating scores of new hues from the gummy darkness of coal tar and other plentiful substances. We must pay homage to their success in elaborating new bases and solvents for the modern lacquer paints which carry the novel hues so effectively and help brighten a dingy world. We are materially richer for a whole series of such products which combine utility with beauty and not only withstand wear, weather and rough usage but have a patina which is equally agreeable to the eye and to the touch.

Here and there we find unwelcome innovations, imported crudities which, as to both color and design, smack of Bolshevistic fondness for ugliness in the raw. And

yet for the most part our plunge into the field of color has been a happy experience and one which we need not repent so long as we submit to the restraint of reasonably good taste.

EXTRACTORIALS

The dyer and colorist to-day must be interested in the textile industry. He must further be interested in and know a great deal of chemistry, because he is the meeting point, where the art and science and knowledge of the textile industry and the art and science and knowledge of chemistry come together, the application of color to the fiber being the result.—*E. F. Armstrong, in the Journal of the Society of Dyers and Colourists.*

All drycleaners know that most of their troubles in cleaning and dyeing silks are caused by excessively weighted fabrics. Many millions of dollars have been paid out by drycleaners to complaining patrons for claims based upon overweighted silk, and for which nobody is responsible other than the man who forced the dyer to overweight it.—*From the National Association of Dyers and Cleaners Review.*

A combination of [dyestuff] manufacturers could operate as successfully as the larger dyestuff makers, and in view of the present domestic competition it would seem imperative that they have a foreign outlet to tide them over the present period of price-war and until the domestic manufacturers awaken to the fact that it is ruinous to take the other fellow's business at a loss.—*Editorial, The Textile Colorist.*

A young chemist in 1907 was taught in a very similar manner to his forerunner of 1887, but the last twenty years have witnessed an upheaval of scientific thought of the most far-reaching character. New and revolutionary ideas have been promulgated and accepted.—*Sir Alfred Mond, addressing the Central Economic League.*

We have heard much about the remarkable fastness properties of the dyes of the ancients and we marvel at the discovery of Egyptian mummy cloths over 4,000 years old which still contain sufficient of their original color for identification purposes. We must remember, however, that these cloths have remained in sealed tombs through the ages, and it is a well-known fact that if the same cloths were exposed to direct sunlight for a period of six months they would lose a good share of their color. On the other hand, it is now possible to produce hundreds of shades on cotton, rayon or silk fabrics which are practically as durable as the fabrics themselves.—*Dr. W. M. Scott, in Dyestuffs.*

This is an era of keen competition in international trade in which giants are matched against giants. But rather than engage in destructive economic warfare, the solution is the regulation of competition, especially in neutral markets, and international cartels are growing rapidly for this purpose.—*J. George Frederick, in Chemical Markets.*

MAURICE PRUD'HOMME

Maurice Prud'homme died at Paris, October 7, 1927, in his eightieth year. He was born at Colmar, educated at the Lycee of Nancy and at the Ecole Polytechnique. He served as an officer in the French Army in the war of 1870; began his scientific work at Mulhouse with Steinbach-Koechlin, and lived the latter years of his life in Paris in the laboratory of the College du France. Among the honors bestowed upon him were the gold medal of the Societe Industrielle de Mulhouse, the gold medal of the Society of Dyers and Colourists, a testimonial organized by the Association General du Chimistez de l'Industrie Textile in 1913, in recognition of his achievements during the past forty years, and the high distinction of Chevalier of the Legion d'Honneur. Though most of his work related to dyeing and similar textile problems, his restless activity touched chemical science in many other directions.—Rev. Gen. du Materier Colorantes, 31, 367.

FIRE DESTROYS KILLHEFFER GREENHOUSES

Friends of Dr. E. H. Killheffer, vice-president of Newport Chemical Works, and president of the American Association of Textile Chemists and Colorists, will be sincerely sorry to learn that the very elaborate greenhouses which he had developed over a period of years at his residence at North Caldwell, N. J., were almost totally destroyed by fire on Wednesday afternoon, January 18.

Floriculture has been the chief hobby of Dr. Killheffer for a period of years, and he had spent a great deal of time and money in creating one of the finest amateur plants in the Metropolitan neighborhood. The fire occurred during Dr. Killheffer's absence, and its origin has not been explained.

LARGEST BRITISH INDUSTRIES FAIR SET TO OPEN THIS MONTH

Will Be Visited by Many American Business Men

Always a red-letter event in England, this year the British Industries Fair will be even larger than the record-breaking display held in 1927, according to an announcement from the British Consulate General in New York. The Fair will be held simultaneously in London and Birmingham from February 20 to March

2. Representatives of many American firms will attend it, according to the announcement.

Assembling under one roof in the two cities named exhibits of products of all the major industries of Great Britain, the annual Industries Fair invariably attracts thousands of visitors from all parts of the world. This year a number of new and interesting sections have been added, among which the Photographic, Optical and Scientific Exhibit is noteworthy.

As a special ruling makes it necessary for exhibitors to display only articles of their manufacture, it is pointed out that buyers will have the satisfaction of dealing directly with the producers of whatever goods they may be interested in.

RECENT LITERATURE

Color Mixing—Its Science

Textile Color Mixing. By David Paterson. Third Revised Edition. 140 pages. Illustrated. D. Van Nostrand Company, New York. $4.50.

This manual on the science of color phenomena as related to the work of dyers, calico printers and textile chemists has been a standard for several years. In the new edition the original text has been largely preserved, but the modern prototypes of pre-war dyes have been substituted throughout.

A theoretical working knowledge of color science is regarded to-day as indispensable to perfect craftsmanship in dyeing and printing. This book deals with the science underlying the mixing of dyes to produce combination shades, explaining thoroughly the various optical factors encountered in ordinary dyehouse practice. Several color plates, numerous black and white diagrams and several pages of sample swatches are of practical aid in illustrating the principles expounded in the text.

The material is presented lucidly and interestingly and the book in its new revision will ably fill the important niche held by the older editions.

Fabric Design

Grammar of Textile Design. By H. Nisbet, F.T.I. Third Edition, Revised and Enlarged. 554 pages; 669 illustrations. D. Van Nostrand Company, New York. $9.00.

Inasmuch as this treatise on the fundamental principles of structural design in woven fabrics was first issued a quarter of a century ago, the publication of a third edition at this time obviously indicates its true value as a standard textbook for students of weaving. For since it first appeared numerous other volumes have been issued on the subject, each in turn professing to be not only the latest word but also the permanent work to which references would be made for many years to come. Few of these later works have survived the same test of time as "Grammar of Textile Design."

The text of the previous edition has been revised in part and enlarged by descriptions of several American types of flat steel doups for heald and Jacquard harnesses for gauze, leno and other varieties of crossweaving. An additional chapter on rayon in woven fabrics brings the work quite up to date. It is abundantly illustrated, thirty-two new drawings having been added to this edition.

Reviewing Chemical Research

Annual Survey of American Chemistry—Vol. II: 1926-1927. National Research Council. Edited by Clarence J. West. 415 pages. Chemical Catalog Company, New York. $3.00.

No important group of scientists and technologists in the United States is more thoroughly qualified to report upon the research being pursued in every field of American science than the National Research Council. What, in view of this fact, could be more fitting than that its Division of Chemistry and Chemical Technology should undertake a survey of the annual progress of contemporary chemical research?

The first volume of this admirable series, issued last February, covered the period from July, 1925, to July, 1926. The second, now issued, brings the survey up to July, 1927. The first volume was a symposium to which thirty-two leading chemists contributed; in the new volume contributions from twenty more authorities have been added, on as many more phases of research activity, and several new authors have reviewed fields covered in the first book.

Scientific advances made in this country in every division of modern chemistry, both academic and industrial, are comprehensively outlined. The authors show a breadth and depth of knowledge in their treatment of their subjects that comes only of an intimate acquaintance with the particular fields under investigation, and that gives to the entire survey a prestige seldom achieved in technical literature.

A number of the chapters dealing with branches of organic chemistry should be of interest to textile and dyestuff chemists. Progress in rayon manufacturer is discussed by W. Hale Church, of the Du Pont Rayon Company; azo dyes and intermediates by Emmet F. Hitch; vat dyes by Oakley M. Bishop and Herbert A. Lubs. Recent contributions to the theory of colloid chemistry are discussed by Harry B. Weiser, Professor of Chemistry at the Rice Institute; X-ray examination of materials by Dr. George L. Clark;

researches on proteins are surveyed by Phoebus A. Levine and F. W. Bass; water and sewage chemistry by Edward Bartow.

Numerous references to technical literature are given in each chapter, so that the volume constitutes an authoritative guide to every field of modern chemical science.

pH Control in Many Industries

The A B C of Hydrogen Ion Control. By W. A. Taylor, Ph.D. Fourth Edition. 124 pages. Illustrated. La Motte Chemical Products Company, Baltimore.

The detection and control of acidity and alkalinity in chemical processing has been a subject of intensive study in many diversified fields of science and manufacturing. Hydrogen ion control, in other words, has decisively proved its value and is now widely recognized among the foremost chemists as a fundamental factor that determines the success or failure of many research experiments and industrial processes.

In reviewing the first edition of "The A B C of Hydrogen Ion Control" in these colums it was said that a good deal of mystery surrounds the modern methods of pH determination, a fact that has served to retard its introduction into textile processing. That statement was made about one year ago. Interest in the application of hydrogen ion control to dyeing and bleaching has been steadily increasing. Discussion of the subject has bred further discussion.

A clearly presented elementary treatise of this kind, therefore, becomes of genuine interest and value to plant chemists who are seeking an intelligent introduction to the whole subject of pH control methods. The new edition is considerably enlarged, particularly in the discussion of hydrogen ion determination as applied in various industries. The section devoted to textile processing lists numerous references to technical literature, many of them articles that have appeared in the REPORTER.

A USEFUL YEAR BOOK

To the editor's desk has come a copy of the "Vade Mecum" or Year Book issued for 1928 by the British Colour Users' Association. It is a pocket diary and memo book covered in red leather and printed on an excellent grade of paper. The first hundred pages contain a wealth of information of practical use to all dyestuff users. There are numerous statistics and tables of weights and measures, including conversion tables of the metric system, thermometer scales, etc.; statistics on dyes imported and exported and lists of committees, officers and members of the Colour Users' Association, the members being classified in the list under their respective trades. A useful chronology of events in the British dyestuffs industry covering the past seventeen years, a list of British color manufacturers and the text of various acts affecting the welfare of the industry make the book as valuable for dyestuff manufacturers as for consumers.

RAYON REACHED NEW HEIGHTS IN 1927
Production Greatly Increased—Many New Uses

A prosperous year in the rayon manufacturing industry is jubilantly reported in statistical surveys of production and consumption of rayon in the United States during 1927. On the basis of its latest record the industry is laying plans for the current year that, it hopes, will assure to it an equally profitable record of business for 1928. Based on the production schedules of the leading manufacturers, output for this year will be about ninety million pounds.

But the figures for the past year are more interesting than any forecasts. Total production in this country in 1927 was nearly 77,000,000 pounds, an increase of approximately 20 per cent over the total for the preceding year, and almost 50 per cent above the 1925 production figure.

Nor did the demand or consumption lag. In addition to a record-making production, an estimated carry-over of nearly ten million pounds was consumed, making total consumption 85,000,000 pounds for the year. This did not include imports of foreign rayon to the total of 15,000,000 pounds.

The products of leading manufacturers, such as Tubize and Celanese, it is further reported, made continual progress in extension of their utilization in textiles, as well as in improvement in quality and popular prestige—progress not equaled by the record of any previous year. At present about 95 per cent of the total production of this country is controlled by five manufacturers, divided into two groups according as their process of manufacture is the viscose or the cellulose acetate.

NEWLY FORMED COUNCIL DETERMINES RESEARCH PLANS OF I. C. I.

Imperial Chemical Industries, Ltd., the British dye and chemical trust, has recently organized a Chemical Research Council to supervise the various lines of technical research undertaken by the company. Described as a kind of clearing house for new chemical discoveries and research policies, the council will also act as liaison between the British chemical industry and the universities. In this function its aim will be to promote both pure science or academic research and practical industrial research, in which the findings of the former type of study are applied to actual manufacturing processes.

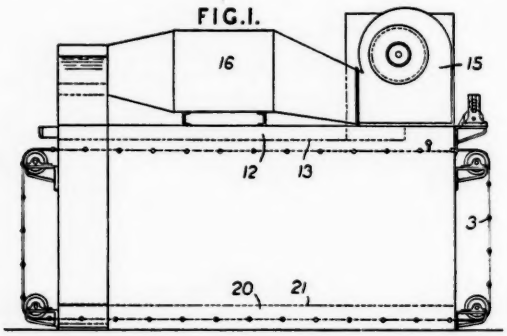
While the main function of the new council will be advisory, according to a report from the Department of Commerce, such a co-ordinate body will be able to gather and disseminate to the various units of the chemical trust all technical information related to its fields of operation.

Technical Notes from Foreign Sources

Drying Yarns and Fabrics

British Patent No. 273,785 is concerned with a process for drying materials in long length, the textile articles being carried on endless-belt conveyors. The yarns and other textile materials which must be dried are supported either in festoons or in hank form upon bars 3 (shown in the accompanying figure), which are

FIG.I.



conveyed through the drying chamber by endless chains disposed at the sides of the chamber. Heated air is circulated continuously from the bottom upward through the chamber by means of the fan 15. The suction side of the fan communicates with a space 12 at the top of the chamber, while the pressure side communicates through a heater 16 and vertical side ducts with a space 20 which is located at the base of the chamber. The spaces 12 and 20 are separated from the drying space by means of the perforated plates 13 and 21. When the yarn is dried in festoons, a finger 11 is provided to prevent the fold already formed from dragging the following length of yarn. The yarn may be formed in tiers of festoons.

Detecting Complete Development of Indigosols and Soledon Colors on Wool

It has been observed that certain Indigosol dyeings, when examined by means of ultraviolet radiation for the purpose of comparing faded and unfaded portions, showed a strong violet fluorescence on the original dyeing, but not on the portions exposed to light for some weeks. It was also noted that some Indigosol dyeings developed, by different methods of oxidation in some cases, strong fluorescence, while in others none appeared.

The purpose of the investigation was to determine the cause of these anomalous results and to test the possibility of the use of ultraviolet radiations as a check on the correct development of the leuco—or other compound on the wool—and hence assist the dyer in producing fast dyeings.

Examination was made of Indigosol O in solution and after application to wool, with the aid of ultraviolet radiation. Indigosol O in substance gives a violet fluorescence and a 0.1 per cent solution; either acid, alkaline or neutral, gives a brilliant violet fluorescence which practically disappears at a dilution equivalent to a 0.00001 per cent solution. It has been remarked that the vat prepared from Indigo LL with ammonia and hydrosulphite gives a brilliant yellow fluorescence. Wool dyed from this vat and completely oxidized shows no fluorescence in full shades.

Pieces dyed with 10 per cent Indigosol O and developed with different agents were examined. With sodium nitrite, less than 2 per cent on the weight of wool, and a sulphuric acid bath, 5 c.c. per liter, at the ordinary temperature, development was incomplete and the wool showed fluorescence.

It was also found that unoxidized or undeveloped Indigosol O may be extracted from the dyed wool with the aid of dilute ammonia or sodium carbonate. When completely removed the wool no longer fluoresces, but the extracted solutions do fluoresce as long as they contain any Indigosol. The exhaustion of the acid dye bath may also be controlled by ultraviolet radiation, as in a properly exhausted bath only a faint fluorescence is visible.

A 10 per cent shade of Indigosol O on white worsted, oxidized with 2 per cent sodium nitrite and sulphuric acid, and evidently incompletely developed, showed a strong violet fluorescence. The sample was examined in the Fade-ometer for two and one-half hours. The fluorescence disappeared at the end of this time. On subsequent examination of the sample in daylight, the color was seen to be considerably darkened. When fully developed a pattern of a 10 per cent shade of Indigosol O showed no fluorescence and no change in hue on exposure in the Fade-ometer for the same period of time. It was also determined that short exposure in the latter instrument will show whether material dyed with this particular class of dyestuff is fast to light. If undeveloped dyestuff is present a change in shade will be observed, followed by loss of fluorescence when exposed to ultraviolet radiation.

On examination of Indigosol O and Soledon colors under the ultraviolet light it was found that the dye powders show a distinct fluorescence and change their color rapidly on exposure to the emanations. In examining pale shades of Indigosol O, it is sometimes difficult to tell whether the color is due to fluorescence of undeveloped coloring matter or to some other cause. It has been found that immersion of the sample in a warm 1 per cent solution of ammonia, followed by an examination of the extract in ultraviolet

light, is a certain test for the presence of undevelpoed coloring matter. (Journal of the Society of Dyers and Colourists, 1927, pp. 266-267.)

Rose Color on Bleached Cotton

The article, published in Revue Generale Teinture Imprim. Blanch. App., 1927, Vol. 5, pp. 429 to 435, is concerned with the problem of the spontaneous development of a rose coloration on bleached cotton. This color, which is often met with on these goods, is held to be due to the formation of Magenta. In other words, it is due primarily to the absorption of aniline vapors. The aniline may enter into a reaction with formaldehyde, derived from formic acid, to form anhydro-formaldehyde aniline. This then reacts with aniline to form the dye in the presence of free acid. The free acid remains behind after the bleaching process. An oxidizing agent must also be present.

It is held that the presence of air is necessary for this development to take place. On the other hand, the oxycellulose, which is always present to a greater or lesser degree in the bleached cotton fibers, may also act as a catalytic agent and exert an oxidizing action.

It may also be held that the bleached cotton, containing oxycellulose, absorbs aniline vapors which are then oxidized by the action of atmospheric oxygen. The absorption is found to be very rapid in the case of strongly hydrated cotton, and it has been observed that a yellowish color will form on the cotton, indicative of a partial oxidation, when the fabric is exposed to aniline oil vapors, the exposure lasting no more than ten minutes.

When a sample of raw cotton is exposed to these vapors, the cotton does not color on exposure to the air. On the other hand, cotton which has been digested in an alkaline liquor develops the color slightly. The degree of color obtained depends on the concentration of the alkali used and on the time of digestion. Bleached cotton, on the other hand, develops the color in proportion with the degree of bleaching.

Experimental Yarn Sizing

Yarn sizing is a very variable process in that the composition of the size, the temperature, time and other important factors may vary within wide limits. The important question is to determine what effect variation in these factors have on the finished yarn. A special machine was built to be able to simulate plant conditions in a laboratory investigation of the problem.

This machine consisted of a size boiler and a small scale sizing machine. The boiler was provided with a water jacket in which the water heating medium was maintained at the proper, constant temperature by means of a thermal regulator. The sizing machine was specially designed for this purpose. This investigation was limited to the sizing of flax yarns.

The experiments carried out were concerned with the effect of variations in the concentration of the size, in the duration and temperature of its cooking, and in the character of the starch used. Above a certain temperature limit, which varies for different starches and which is usually well below 100 deg. Cent., no great difference is found in the character of the size produced by cooking at various temperatures. The duration of the cooking treatment appears to have but little effect over the range from fifteen minutes to six hours. In most of the work in these experiments a standard time of one hour and a standard temperature of 100 deg. Cent. were used. The concentration of the starch produces an effect such that the protective power of the resulting size is, in most cases, proportional to the concentration.

The admixture with the size of various oils and fats has been found in every case to produce a deterioration in the protective power when applied to the yarn. The admixture of glycerin, on the other hand, enhances the protective power. The behavior of the oils and fats is quite different, however, when they are applied to the surface of the yarn which has been sized and dried. Here a marked improvement is brought about in every case. Paraffin wax and stearin appear to be the most powerful of all the materials examined. (The Journal of the Textile Institute, 1927, pp. 1303-1310.)

Fast Shades on Textile Fibers

Ten grams of cotton yarn are impregnated with 200 c.c. of a solution which contains 10.5 grams of 2-oxynaphthalene-3-carboxylanilide per liter, 17.5 grams of a solution of sodium hydroxide (34 deg. Be. concentration), 22 grams of Turkey Red oil, 8 c.c. of formaldehyde (30 per cent concentration) and 30 grams of sodium nitrite. The squeezed yarn is then entered into 200 c.c. of a solution of 0.95 gram of 2:5-dichloro aniline hydrochloride and 7.5 grams of aluminum sulphate per liter. The shade obtained in this manner is an orange with a reddish tinge.

Twenty grams of acetate rayon is treated for a period of sixty minutes at a temperature of 55 to 60 deg. Cent. in 500 c.c. of a solution containing 0.4 gram of 2:2'-dichlorobenzidine per liter, 2.4 grams of sodium 2-oxynaphthalene-3-carboxylate, 50 c.c. of a 5 per cent solution of soap and 200 c.c. of a 10 per cent solution of sodium nitrite. After the liquor has been pressed out of the acetate fibers, the dyeing is developed by treating for a period of thirty minutes at a temperature of 50 deg. Cent. in 500 c.c. of a solution of 50 c.c. of acetic acid (6 deg. Be. concentration) per liter. A bluish red shade is obtained in this manner. (French Patent No. 603,710.)

WILLIAM FERGUSON

William Ferguson, a director and general manager of A. Klipstein & Co., Ltd., Montreal, the Canadian representatives of A. Klipstein & Co.,, New York, died at his residence, 1025 Sherbrooke Street, W. Montreal, February 1, 1928.

Mr. Ferguson was fifty-five years of age. In 1893 he entered the employ of A. Klipstein & Co., in their New York laboratories. About ten years later he was transferred to Montreal and subsequently assumed the management of their Canadian house, and remained in that capacity until the present time.

Mr. Ferguson's acquaintances in the trade, and in all of Canada, and in the United States were very numerous and, due to his wide experience and ability, his knowledge on technical matters was keenly sought and relied upon without question.

He was a graduate of Cooper Institute, New York, and a member of many Canadian clubs and associations.

He leaves a widow and two children.

PLANT DEVELOPMENT OF MATHIESON ALKALI OUTLINED IN FINANCIAL REPORT

A recent report covering the financial condition, earnings, dividends and depreciation costs of the Mathieson Alkali Works, Inc., alludes in part to the program of plant rehabilitation that has been worked out by the company in recent years.

In the past four years the main plants of the Mathieson works have been re-equipped and in one case rebuilt. The Niagara Falls electrolytic plant, formerly an old-fashioned bleach factory, was changed to the largest liquid chlorine plant in the world, and a modern synthetic ammonia plant was installed.

The plant at Saltville, Va., was practically remodeled entire without cessation of operations. The latest low-cost equipment was installed, including electric drives throughout and pulverized coal installation for boilers and furnaces as well. The factory town has also received many needed improvements, including a hospital and community houses. Acquisition by the company of important raw material deposits has placed it in a strong position as one of the principal producers in the industry.

PASTE RESISTS SHOWN IN NEW GENERAL DYESTUFF CARD

Attractive samples of paste-resisted cotton piece goods are displayed in a new pattern card being distributed by the General Dyestuff Corporation. The card, entitled "Paste Resists Under Indanthrene Dyeings," contains swatches of twenty-four novel print patterns in one and two color combinations. The text of the card explains the process for producing the designs shown, from the preliminary treatment of the goods to the finished dyeings, with a list of the colors suitable for the different kinds of vat.

BACHMEIER AGENTS FOR CABLE YELLOWS

The Chinoline Yellows being featured by the Cable Manufacturing Company, of Chicago, are now handled by their exclusive selling agents, Bachmeier & Co., of New York.

These Chinoline Yellows, marketed in single and double strength, according to an announcement recently made by the latter company, produce bright greenish shades of yellow, and are described as extremely soluble dyes used largely for self-colors. They may also be used with various fast blues and greens and are easily dischargeable. Although used extensively in the wool and silk dyeing industries, according to the makers they are also applicable to rayon and to paper sulphite when brilliant shades are desired.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

CHEMIST WANTED

Wanted—Chemist who has had practical plant experience in the production of Azo colors and the intermediates required in the manufacture of Azo colors. Please state experience and salary desired. Address: Classified Box 440, American Dyestuff Reporter.

SALESMEN WANTED

Manufacturer offers a splendid opportunity to one or two men who have successfully sold dyestuffs, chemicals and related specialties. Salary and commission. Men without experience need not apply. State full particulars. Address Classified Box 443, American Dyestuff Reporter.

TEXTILE CHEMIST

Young chemist experienced in the bleaching and dyeing of cotton and rayon, familiar with direct, diazo, sulphur and vat colors, seeks position in New York district. Hard worker. Address Classified Box 444, American Dyestuff Reporter.

WANTED—PARTNER AND SALESMAN
Textile Sizes—Finishers—Softeners

Central corporation, progressive and soundly established, offers unusual opportunity to salesman to become member of firm. Immediate investment unnecessary. The man wanted must control sufficient business in this line and know the business thoroughly, and has possibly considered starting his own business. Room 1107, Hotel Carteret, 208 West Twenty-third Street, New York.